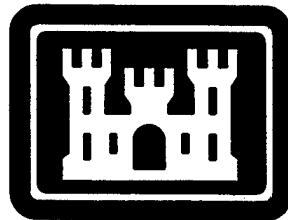


# UMCS FEASIBILITY STUDY

FOR

# Fort George G. Meade

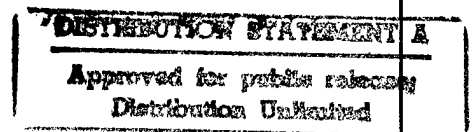


US Army Corps  
of Engineers

U.S. ARMY ENGINEER DISTRICT, BALTIMORE  
CORPS OF ENGINEERS  
BALTIMORE, MARYLAND

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READING, PENNSYLVANIA

DECEMBER 1996

VOLUME 1 OF 3

DATA QUALITY INSPECTED 13




DEPARTMENT OF THE ARMY  
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS  
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### **Fort George G. Meade Department of Public Works**

Randy Johnson, Chief, Management Engineering Systems Branch

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### Acronym Table

A/C	Air Conditioning
AHU	Air Handling Unit
BHP	Boiler Horse Power
BTU	British Thermal Unit
CHW	Chilled Water
DHW	Domestic Hot Water
DoD	Department of Defense
DPW	Department of Public Works
DX	Direct Expansion
ECIP	Energy Conservation Investment Program
ECO	Energy Conservation Opportunity
EEAP	Energy Engineering Analysis Program
EMCS	Energy Monitoring and Control System
EMS	Energy Management System
ESA	Energy Savings Analysis
gal	Gallon
HVAC	Heating, Ventilating, and Air Conditioning
HW	Hot Water
kW	Kilowatt
kWh	Kilowatt Hour
LCC	Life Cycle Cost
mcf	Thousand Cubic Feet
mmBTU	Million BTU
OA	Outside Air
SIOH	Savings, Inspection and Overhead
SIR	Savings to Investment Ratio
UMCS	Monitoring and Control System
VAV	Variable Air Volume

## **1.0 EXECUTIVE SUMMARY**

### **1.1 Introduction**

Fort George G. Meade selected eighty-three (83) buildings, from the approximately 1,500 buildings on the base to be included in the UMCS Feasibility Study. The purpose of the study is to evaluate the feasibility of replacing the existing analog based Energy Monitoring and Control System (EMCS) with a new distributed-process Monitoring and Control System (UMCS). Entech was authorized to perform this study by the following:

Authorization: by memorandum, CEMP-ET, subject: "Energy Engineering Analysis Program (EEAP) - FY95", dated 29 December 1994.

### **1.2 Objective**

The objective of this study, as explained in the brief Description of Work (Attachment 8.1 in Volume 2 of 3) of the contracts are as follows:

- A. Review for general information the available design, construction, and operation data for the existing Energy Monitoring and Control System (EMCS).
- B. Perform a limited site survey of selected buildings or facilities to verify construction features, electrical and mechanical equipment, occupancy, and mode of operation for energy analysis.
- C. Evaluate the technical and economic feasibility of replacing the existing EMCS with a new, distributed-process monitoring and control system (UMCS).
- D. Evaluate UMCS application programs (software) for all buildings or facilities using data from similar buildings to determine their energy

savings potential and economic feasibility for connection to the new UMCS.

- E. Provide project documentation for recommended ECOs as detailed herein.
- F. Prepare a comprehensive report to document all work performed, the results and all recommendations.

### **1.3 Report Organization**

The study consists of three volumes. Volume 1 of 3 contains the study, Volume 2 of 3 contains the scope of work and the backup data, and Volume 3 of 3 contains the remainder of the back-up data. The following sections are contained within Volume 1 of 3:

- A. Section 1 Executive Summary
- B. Section 2 Methodology, describes in detail software and techniques used in the analysis.
- C. Section 3 Facility Description, contains tables summarizing building characteristics and occupancy.
- D. Section 4 Energy Costs, quantifies energy costs for electricity, natural gas, and fuel oil.
- E. Section 5 Building by Building UMCS Analysis, contains energy calculations, construction costs, and Life Cycle Cost analysis on each building and a summary of all buildings together.
- F. Section 6 Base UMCS Energy Conservation Opportunity (ECO), contains energy calculations, construction costs, and Life Cycle Costs analysis for buildings within the ECIP requirements as one ECO.
- G. Section 7 Conclusion.

### **1.4 Facilities Description**

Fort Meade is an administrative post for the Military District of Washington and provides a place for federal personnel to work and live. Fort Meade

provides a base operations to support tenant activities which include all service branches, Department of Defense activities and federal agencies. Fort Meade includes approximately fifteen hundred (1,500) buildings and encompasses 5,408 acres. Fort Meade houses numerous support facilities for education, administration, maintenance, medical, recreation, mercantile, and personal housing.

Section 3.0 provides information on each building included in the scope of this study in tabular form. The eighty-three buildings within the scope of this study have a total area of 2,645,816 square feet. Table 1.4.1 displays breakdown of floor space by building type.

<b>Table 1.4.1</b> <b>Building Inventory Statistics</b>			
<b>Type</b>	<b>Area (s.f.)</b>	<b>No. Buildings</b>	<b>Average (s.f.)</b>
Administrative	923,872	24	38,495
Housing	1,091,591	26	41,984
Maintenance	65,769	8	8,221
Mercantile	229,903	7	32,843
Storage	29,909	2	14,955
Housing Support	304,772	16	19,048
<b>Total</b>	<b>2,645,816</b>	<b>83</b>	<b>31,877</b>

## 1.5 Energy Costs

The following energy costs were derived from actual Fort Meade energy bills. Refer to Section 4.0 for how these costs were arrived at.



<b>Table 1.5.1</b> <b>Base Energy Cost</b>		
<b>Fuel Type</b>	<b>Cost \$/unit</b>	<b>\$/mmBtu</b>
Electric Usage	\$0.032 / kWh	\$9.38
Electric Demand	\$96.28 / year	---
Natural Gas	\$3.97 / mcf	\$3.85
Fuel Oil	\$0.62 / gallon	\$4.47

### 1.6 Building by Building Analysis

Each building was evaluated individually. Central strategies were developed for each building. Control point counts and energy savings were developed based on the control strategies. The control strategies and point counts were based on the Army Energy Monitoring and Control System technical manual TM5-815-2. The annual energy savings were developed using the Energy Savings Analysis (ESA) and EZDOE energy simulation programs. Each of these programs are described in Section 2.4 and 2.5 of this study. Then a construction cost to implement the control strategies and points was estimated using the draft edition of the UMCS Cost Estimator program. The final step was to run a Life Cycle Cost analysis in order to determine the savings to investment ratio (SIR) of each building.

Table 1.6.1 summarizes each building's point total, energy savings, construction costs and investment. A life cycle cost analysis was calculated for all eighty-three buildings added together. Using a total construction cost of \$3,484,180 and saving of \$582,770 for all 83 building, the SIR for all buildings as one project is 1.47 with a simple payback of 5.97 years.

**TABLE 1.6.1**  
**UMCS FEASIBILITY STUDY**  
**FORT MEADE**  
**DISTRIBUTED-PROCESS MONITOR AND CONTROL SYSTEMS (UMCS)**  
**SYSTEMS SUMMARY ECONOMICS ANALYSIS**

Building	Number of Points	Savings			First Costs				Investment	
		mmBtu	Dollar \$	EMCS Maintenance \$	Construction Cost \$	SIOH \$	Design Cost \$	Building Total \$	SIR	Simple Payback (years)
370	43	388	\$2,400	\$2,460	\$32,450	\$1,780	\$1,950	\$36,180	1.14	7.42
375	9	107	\$800		\$7,970	\$440	\$480	\$8,890	0.76	11.49
393	12	533	\$3,500		\$5,960	\$330	\$360	\$6,650	4.51	1.92
504	5	382	\$2,700	\$730	\$4,570	\$250	\$270	\$5,090	5.67	1.49
909	63	785	\$5,900		\$53,700	\$2,950	\$3,220	\$59,870	0.84	10.21
940	16	489	\$2,500	\$730	\$8,240	\$450	\$490	\$9,180	3.24	2.81
1978	58	1,601	\$11,500		\$68,080	\$3,740	\$4,080	\$75,900	1.29	6.61
1976										
2212	40	176	\$2,000	\$730	\$26,820	\$1,480	\$1,610	\$29,910	0.74	11.02
2220	26	489	\$3,500	\$860	\$18,830	\$1,040	\$1,130	\$21,000	1.79	4.81
2234	34	799	\$6,000	\$980	\$45,960	\$2,530	\$2,760	\$51,250	1.14	7.38
2251		0	\$0							
2253	6	305	\$1,900	\$370	\$4,110	\$230	\$250	\$4,590	4.32	1.98
2257	62	2,039	\$11,300	\$980	\$79,470	\$4,370	\$4,770	\$88,610	1.21	7.24
2282	39	350	\$2,700		\$48,170	\$2,650	\$2,890	\$53,710	0.43	19.57
2481	22	718	\$5,000	\$1,110	\$16,670	\$920	\$1,000	\$18,590	2.87	3.03
2482	39	556	\$2,800		\$264,910	\$14,570	\$15,890	\$295,370	0.09	104.26
2484	21	565	\$3,900		\$19,380	\$1,070	\$1,160	\$21,610	1.59	5.51
2490	45	4,996	\$24,000		\$52,420	\$2,880	\$3,150	\$58,450	3.92	2.42
2501	55	201	\$2,300	\$370	\$32,140	\$1,770	\$1,930	\$35,840	0.61	13.54
2786	42	1,756	\$10,700		\$43,140	\$2,370	\$2,590	\$48,100	1.94	4.50
2789	40	378	\$3,300	\$1,350	\$44,260	\$2,430	\$2,660	\$49,350	0.78	10.60
2790	100	4,065	\$21,600	\$5,160	\$45,810	\$2,520	\$2,750	\$51,080	4.63	1.91
2793		0	\$0							
2812	12	98	\$800	\$250	\$15,270	\$840	\$920	\$17,030	0.53	15.99
3000	12	497	\$2,400		\$11,210	\$620	\$670	\$12,500	1.75	5.25
4215	42	2,174	\$12,000	\$1,230	\$58,470	\$3,220	\$3,510	\$65,200	1.76	4.98
4216	35	872	\$5,200	\$730	\$47,200	\$2,600	\$2,830	\$52,630	0.98	8.81
4217	42	900	\$5,200	\$620	\$53,970	\$2,970	\$3,240	\$60,180	0.84	10.40
4411	86	4,074	\$25,800	\$1,230	\$81,230	\$4,470	\$4,870	\$90,570	2.58	3.35
4418	27	69	\$700	\$860	\$32,670	\$1,800	\$1,960	\$36,430	0.34	24.41
4419	67	687	\$4,400	\$980	\$43,020	\$2,370	\$2,580	\$47,970	0.98	8.86
4431	18	240	\$1,600	\$980	\$22,060	\$1,210	\$1,320	\$24,590	0.88	9.65



0401	03	100	\$2,100	\$22,120	\$12,110	\$10,200	\$210,120	0.12	0.50
8485	8	227	\$1,000	\$3,380	\$190	\$200	\$3,770	19.34	0.50
8486									
8606	23	498	\$2,300	\$25,580	\$1,410	\$1,530	\$28,520	1.13	7.81
9801	76	106	\$3,800	\$91,480	\$5,030	\$5,490	\$102,000	0.61	13.26
9802									
9803									
9804									
9810	65	1,656	\$7,900	\$53,240	\$2,930	\$3,190	\$59,360	1.72	5.13
9827	25	389	\$1,800	\$5,910	\$330	\$350	\$6,590	2.52	3.66
9828	25	738	\$3,700	\$5,280	\$290	\$320	\$5,890	5.63	1.61
9829	18	1,770	\$7,700	\$10,370	\$570	\$620	\$11,560	6.39	1.45
<b>TOTALS</b>	<b>2,926</b>	<b>89,175</b>	<b>\$501,100</b>	<b>\$3,124,800</b>	<b>\$171,900</b>	<b>\$187,480</b>	<b>\$3,484,180</b>	<b>1.47</b>	<b>5.97</b>

**TABLE 1.6.1**  
**UMCS FEASIBILITY STUDY**  
**FORT MEADE**  
**DISTRIBUTED-PROCESS MONITOR AND CONTROL SYSTEMS (UMCS)**  
**SYSTEMS SUMMARY ECONOMICS ANALYSIS**

Building	Number of Points	Savings			First Costs				Investment	
		mmBtu	Dollar \$	EMCS Maintenance \$	Construction Cost \$	SIOH \$	Design Cost \$	Building Total \$	SIR	Simple Payback (years)
8485	8	227	\$1,020		\$3,380	\$190	\$200	\$3,770	19.34	0.50
8486										
9829	18	1,770	\$7,720	\$250	\$10,370	\$570	\$620	\$11,560	6.39	1.45
504	5	382	\$2,680	\$730	\$4,570	\$250	\$270	\$5,090	5.67	1.49
9828	25	738	\$3,660		\$5,280	\$290	\$320	\$5,890	5.63	1.61
6330	28	4,515	\$20,420	\$1,600	\$32,900	\$1,810	\$1,970	\$36,680	5.47	1.66
2790	100	4,065	\$21,640	\$5,160	\$45,810	\$2,520	\$2,750	\$51,080	4.63	1.91
393	12	533	\$3,450		\$5,960	\$330	\$360	\$6,650	4.51	1.92
2253	6	305	\$1,940	\$370	\$4,110	\$230	\$250	\$4,590	4.32	1.98
4554	154	10,117	\$57,510	\$5,160	\$117,930	\$6,490	\$7,080	\$131,500	4.18	2.10
2490	45	4,996	\$24,010		\$52,420	\$2,880	\$3,150	\$58,450	3.92	2.42
4553	137	8,414	\$47,800	\$6,900	\$118,130	\$6,500	\$7,090	\$131,720	3.63	2.41
940	16	489	\$2,530	\$730	\$8,240	\$450	\$490	\$9,180	3.24	2.81
4471	9	87	\$890	\$980	\$4,340	\$240	\$260	\$4,840	3.22	2.58
4552	91	3,145	\$21,190	\$4,430	\$65,430	\$3,600	\$3,930	\$72,960	2.99	2.84
2481	22	718	\$5,000	\$1,110	\$16,670	\$920	\$1,000	\$18,590	2.87	3.03
4550	151	8,973	\$46,500	\$5,410	\$150,320	\$8,270	\$9,020	\$167,610	2.75	3.23
4411	86	4,074	\$25,770	\$1,230	\$81,230	\$4,470	\$4,870	\$90,570	2.58	3.35
9827	25	389	\$1,790		\$5,910	\$330	\$350	\$6,590	2.52	3.66
2786	42	1,756	\$10,680		\$43,140	\$2,370	\$2,590	\$48,100	1.94	4.50
4700	50	1,154	\$5,290	\$4,060	\$38,720	\$2,130	\$2,320	\$43,170	1.89	4.62
2220	26	489	\$3,500	\$860	\$18,830	\$1,040	\$1,130	\$21,000	1.79	4.81
4215	42	2,174	\$12,030	\$1,230	\$58,470	\$3,220	\$3,510	\$65,200	1.76	4.98
3000	12	497	\$2,380		\$11,210	\$620	\$670	\$12,500	1.75	5.25
9810	65	1,656	\$7,860	\$2,210	\$53,240	\$2,930	\$3,190	\$59,360	1.72	5.13
2484	21	565	\$3,910		\$19,380	\$1,070	\$1,160	\$21,610	1.59	5.51
6530	61	1,956	\$8,990	\$1,720	\$54,390	\$2,990	\$3,260	\$60,640	1.59	5.66
8452	65	1,525	\$7,770	\$2,830	\$53,990	\$2,970	\$3,240	\$60,200	1.55	5.68
1978	58	1,601	\$11,460		\$68,080	\$3,740	\$4,080	\$75,900	1.29	6.61
1976			369,390	46,920				1,279,910	1.3	3.07
2257	62	2,039	\$11,250	\$980	\$79,470	\$4,370	\$4,770	\$88,610	1.21	7.24
7100	27	856	\$4,180	\$860	\$33,490	\$1,840	\$2,010	\$37,340	1.21	7.40
		4,146	\$6,770	\$1,750	\$56,860	\$3,130	\$3,410	\$63,400	1.16	7.46



ROUT	55	201	\$2,260	\$370	\$32,140	\$1,770	\$1,930	\$35,840	U.O.I	10.54
2501	55	201	\$2,260	\$370	\$32,140	\$1,770	\$1,930	\$35,840	0.55	15.98
8465	36	364	\$1,930	\$860	\$40,070	\$2,200	\$2,400	\$44,670	0.53	15.99
2812	12	98	\$820	\$250	\$15,270	\$840	\$920	\$17,030	0.43	19.57
2282	39	350	\$2,740		\$48,170	\$2,650	\$2,890	\$53,710	0.40	21.52
4703	72	489	\$2,640	\$1,720	\$84,210	\$4,630	\$5,050	\$93,890		
4704										
4717										
4720										
4721	72	411	\$1,720	\$1,110	\$73,530	\$4,040	\$4,410	\$81,980	0.37	23.59
4705										
4707										
4709	27	69	\$660	\$860	\$32,670	\$1,800	\$1,960	\$36,430	0.34	24.41
4418	16	84	\$600	\$500	\$27,360	\$1,500	\$1,640	\$30,500	0.31	27.68
4680	33	730	\$3,140		\$221,270	\$12,170	\$13,280	\$246,720	0.12	78.47
8481	39	556	\$2,820		\$264,910	\$14,570	\$15,890	\$295,370	0.09	104.26
2482		0	\$0							
2793										
TOTALS	2,926	89,175	\$500,830	\$81,670	\$3,124,800	\$171,900	\$187,480	\$3,484,180	1.47	5.97

### **1.7 Recommended UMCS Energy Conservation Opportunity (ECO)**

For the Base UMCS ECO to qualify for ECIP funding, each individual building of the ECO must have an SIR greater than 1.25. Of the eighty-three (83) buildings included in the study only thirty (30) buildings have an SIR greater than 1.25.

These thirty (30) buildings were grouped together to form the recommended UMCS Energy Conservation Opportunity. Table 1.7.1 summarizes these thirty buildings. The construction cost for the buildings changed slightly due to system wide UMCS costs that remain the same even though most of the buildings costs were eliminated. Refer to Section 6.2 and Attachment 8.4 for a detailed construction cost breakdown.

A Life Cycle Cost analysis was calculated for all thirty buildings as one recommended ECO. Using the ECO construction cost of \$1,429,630 and saving total of \$434,900, the SIR for these thirty buildings is 2.65 with a corresponding simple payback of 3.33 years. By eliminating buildings which have an individual SIR less than 1.25, the total SIR greatly increased.

This suggested, the UMCS ECO has a total point count of 1,380 points. This point count and the construction cost of \$1,429,630 translates to a dollar per point cost of \$1,036/pt. Industry costs range from \$800/pt to \$1,200/pt. This places the UMCS cost at the middle of the range, which means the UMCS costs are reasonable.



Of the eighty-three (83) buildings included in the study only 36% of the buildings met the required criteria to be included in the recommended UMCS ECO. The recommended ECO includes most of the major buildings on the base. The eighty-three (83) buildings represent a total area of 2,645,816 square feet. The thirty (30) buildings in the recommended UMCS ECO represent a total area of 1,326,781 square feet, which accounts for 50% of the total area studied. These thirty (30) buildings will provide Fort Meade with a good system to build on in the future. Once the UMCS system is installed, buildings that are renovated and not already on the system can be readily added to the system.

It is not surprising that the thirty buildings finally selected to be included within the recommended ECO tend to be the larger; more mechanically intensive, facilities offering the type of energy saving opportunities that justify the expense of installing a new UMCS system. The remaining facilities are small facilities with elementary mechanical system offering little opportunities for any substantial energy savings.

The following sections of this study describe in detail the findings as outlined above and contain the necessary energy and cost estimate backup data as required. The reader is encouraged to carefully review each of the following study sections to understand the assumptions, methodology and discussions involved.

**TABLE 1.7.1**  
**UMCS FEASIBILITY STUDY**  
**FORT MEADE**  
**DISTRIBUTED-PROCESS MONITOR AND CONTROL SYSTEMS (UMCS)**  
**SYSTEMS SUMMARY ECONOMICS ANALYSIS**

Building	Building Usage	Number of Points	Savings		EMCS Maintenance \$	First Costs			
			mmBtu	Dollar \$		Construction Cost \$	SIOH \$	Design Cost \$	Building Total \$
393	Administrative	12	533	\$3,450		\$6,570	\$360	\$390	\$7,320
504	Training Aide Center	5	382	\$2,680	\$690	\$7,780	\$430	\$470	\$8,680
940	Morale Support Office	16	489	\$2,530	\$690	\$12,000	\$660	\$720	\$13,380
1978	Administrative	58	1,601	\$11,460		\$71,020	\$3,910	\$4,260	\$79,190
1976	Warehouse								
2220	Guided Missile Maintenance Facility	26	489	\$3,500	\$810	\$20,780	\$1,140	\$1,250	\$23,170
2253	DS Vehicle Maintenance Shop	6	305	\$1,940	\$350	\$4,410	\$240	\$260	\$4,910
2481	Unaccompanied Enlisted Personnel Housing	22	718	\$5,000	\$1,050	\$17,770	\$980	\$1,070	\$19,820
2484	Medical Supply Warehouse	21	565	\$3,910		\$20,440	\$1,120	\$1,230	\$22,790
2490	Laboratory	45	4,996	\$24,010		\$54,680	\$3,010	\$3,280	\$60,970
2786	Commissary	42	1,756	\$10,680		\$45,260	\$2,490	\$2,720	\$50,470
2790	Main Exchange, Retail	100	4,065	\$21,640	\$4,900	\$50,840	\$2,800	\$3,050	\$56,690
3000	FE Facility	12	497	\$2,380		\$11,820	\$650	\$710	\$13,180
4215	Administrative	42	2,174	\$12,030	\$1,160	\$60,590	\$3,330	\$3,640	\$67,560
4411	Administrative	86	4,074	\$25,770	\$1,160	\$85,560	\$4,710	\$5,130	\$95,400
4471	Credit Union	9	87	\$890	\$930	\$7,770	\$430	\$470	\$8,670
4550	Administrative	151	8,973	\$46,500	\$5,130	\$157,930	\$8,690	\$9,480	\$176,100
4552	Administrative	91	3,145	\$21,190	\$4,200	\$70,010	\$3,850	\$4,200	\$78,060
4553	Administrative	137	8,414	\$47,800	\$6,550	\$125,030	\$6,880	\$7,500	\$139,410
4554	Administrative	154	10,117	\$57,510	\$4,900	\$125,690	\$6,910	\$7,540	\$140,140
4700	Band Training Facility	50	1,154	\$5,290	\$3,840	\$41,240	\$2,270	\$2,470	\$45,980
6330	Physical Fitness Center	28	4,515	\$20,420	\$1,520	\$34,310	\$1,890	\$2,060	\$38,260
6330	Skill Development Center	61	1,956	\$8,990	\$1,640	\$57,460	\$3,160	\$3,450	\$64,070
8452	Administrative	65	1,525	\$7,770	\$2,680	\$58,170	\$3,200	\$3,490	\$64,860
8485	ORG Vehicle Maintenance Shop	8	227	\$1,020		\$7,220	\$400	\$430	\$8,050
8486	ORG Vehicle Maintenance Shop								
9810	Recreation Center	65	1,656	\$7,860	\$2,110	\$56,510	\$3,110	\$3,390	\$63,010
9827	Unaccompanied Enlisted Personnel Housing	25	389	\$1,790		\$7,160	\$390	\$430	\$7,980
9828	Unaccompanied Enlisted Personnel Housing	25	738	\$3,660		\$6,530	\$360	\$390	\$7,280
9829	Enlisted Personnel Dining	18	1,770	\$7,720	\$240	\$11,270	\$620	\$680	\$12,570
<b>TOTALS</b>		1,380	67,309	\$369,390	\$44,550	\$1,235,820	\$67,990	\$74,160	\$1,377,970
								SIR	2.65
								Simple Payback (years)	3.33

## **2.0 METHODOLOGY**

### **2.1 General**

The intention of this report is to assess the technical and economic feasibility of replacing the existing Energy Monitoring and Control System (EMCS) with a new Direct Digital Controls based Distributed-Process Monitoring and Control System (UMCS) at Fort George G. Meade. Entech has developed a thorough format which is adhered to during the development of a report. This format has permitted Entech to construct comprehensive reports in a smooth and timely process. Entech has employed this format in the preparation of over five-hundred (500) energy studies for commercial, industrial and institutional clients.

The following is a listing of the components in Entech's methodology for completing energy studies:

1. Kick-off Meeting
2. Site Inspection/Data Collection
3. ESA Program
4. DOE Program
5. Btu/unit
6. Energy Conservation Opportunities
7. Life Cycle Cost Analysis Summary
8. Draft Report/Client Review/Final Report

### **2.2 Kick-off Meeting**

In order to initiate the process, Entech scheduled a kick-off meeting at Fort Meade on October 3, 1995. Entech was represented by Paul Hottenstein, Craig Snyder, and Eric Goodman. Randy Johnson, Chief, Management Engineering Systems Branch, and Debbie Faux, Supervisor, Bachelor Housing Section, represented Fort Meade.

The purpose of the meeting was to introduce both parties and explain the process Entech was planning to follow during the study. In addition, Fort Meade's expectations were noted and incorporated into the project.

### **2.3 Site Inspection/Data Collection**

Entech performed site investigations at Fort Meade on each building listed in the project scope. Entech investigated the heating, ventilating, and air conditioning (HVAC) systems in each building and interviewed Directorate of Public Works personnel to acquire an accurate overview of building function and operation.

The following additional information was also collected:

1. Building construction
2. Building photographs
3. Operating schedules
4. Building HVAC drawings
5. Electric, Gas and Fuel Oil billing data

### **2.4 ESA Program**

**General:** The Energy Savings Analysis (ESA) computer program automates the procedures outlined in the Energy Monitoring and Control Systems Technical Manual (TM5-815-2). The program was designed to meet the Energy Engineering Analysis Program (EEAP) requirements for Distributed-Process Monitoring and Control System (UMCS) projects. The program provides reasonable approximations of savings, but it will not provide a detailed energy analysis of each building. The program provides yearly savings figures based on selected UMCS conservation programs. This program will be used on the

smaller buildings and buildings with less complicated HVAC systems. The following section provides a short overview of the program and its capabilities.

**Energy Calculations:** ESA calculates annual energy consumption based on the Bin Method. This method uses weather data which is separated into five degree increments known as bins. These bins are then used to estimate the amount of heating or cooling energy a building will use at any given outdoor temperature using engineering calculations. The energy consumption is determined by multiplying the energy requirements at any given temperature by the number of hours at that temperature.

**HVAC Systems:** The program can model twenty-six (26) different HVAC systems, and simulate fifteen (15) different UMCS energy saving strategies.

The energy saving strategies are as follows:

1. Scheduled Start/Stop
2. Duty Cycling
3. Demand Limiting
4. Day/night Setback
5. Ventilation/Recirculation
6. Hot/Cold Deck Temperature Reset
7. Reheat Coil Reset
8. Steam Boiler Selection
9. Hot Water Boiler Selection
10. Hot Water Outside Air Reset
11. Chiller Selection
12. Chilled Water Temperature Reset
13. Condenser Water Temperature Reset
14. Chiller Demand Limit
15. Lighting Control

**Program Output:** The ESA program provides yearly energy savings for selected UMCS energy saving strategies based on system input. The program cannot simulate energy use before and after, only energy savings.

## **2.5 EZDOE**

**General:** Entech utilizes an hourly energy use simulation program known as EZDOE. This program is a PC version of the Department of Energy's simulation program known as DOE-2.1D. The program has the capability of calculating hour-by-hour energy use of all aspects of a building. This program will be used on the larger buildings with more complex HVAC systems. This section will provide a short overview of the program and its capabilities.

**Energy Calculations:** EZDOE calculates the annual energy consumption of HVAC systems based on U.S. Department of Energy standards. The program contains four (4) main simulation sections as follows:

1	Loads
2	Systems
3	Plants
4	Economics

**Loads:** This portion of the program allows the user to construct a database on the building. Some of the areas of input are listed as follows:

1	Exterior and Interior Wall Constructions
2	Roof Constructions
3	Window Details, Exterior Door Details
4	Schedules, Daily, Weekly, and Monthly
5	Luminaire Type and Load
6	People Occupancy Rates
7	Space/Area Definition
8	Miscellaneous Loads Such as DHW Usage
9	General Equipment Load
10	City/Weather References

**Systems:** This section simulates air-distribution systems which can be utilized within a building. Twenty-two (22) different air-handling systems are supported. In general, spaces defined under loads can be attached to systems. The following table lists some features which can be accessed:

1	Variable Air Volume
2	Preheating
3	Night Setback
4	Economizer
5	Reheating, Humidification
6	Baseboard Heating
7	System Scheduling

**Plants:** This section simulates the building's physical plants (boilers, chillers, water heaters, etc.) and other various options. The program has the capability of sizing equipment based on loads or sizes which can be input manually. A wide variety of equipment can be simulated. The following table lists additional features which can be utilized:

1	Peak Shaving
2	Demand Limiting
3	Load Management

**Economics:** This portion provides a means to simulate utility tariffs and costs. Fuel consumption during specific time periods can also be generated. The following is a list of features which can be utilized:

1	Demand Costs
2	On/Off Peak Usage Costs
3	Demand Ratchets
4	Seasonal Rates

## **2.6 Energy Saving Control Strategies**

### **2.6.1 General**

Control strategies and how they may be applied to different types of mechanical systems have been identified in Table 2.6.1. Not all strategies will be applied to each piece of equipment as Table 2.6.1 indicates.



TABLE 2.6.1

Mechanical Systems Controllable By EMCS	EMCS STRATEGY														
	Scheduled Start/Stop	Optimum Start/Stop	Duty Cycling	Demand Limiting	Day/Night Setback	Economizer (dry bulb)	Ventilation Recirculation	Hot/Cold Deck Temp. Reset	Steam Boiler Selection	Hot Water Outside Air Reset	Chiller Selection	Chilled Water Temp. Reset	Condenser Water Temp. Reset	Chiller Demand Limit (centrif only)	Lighting Control
Single Zone AHU	X	X	X	X	X	X	X								
Variable Air Volume AHU	X	X		X	X	X	X								
Multi-Zone AHU	X	X	X	X	X	X	X	X							
Single Zone DX-A/C	X	X	X	X	X	X	X								
Multi- Zone DX-A/C	X	X	X	X	X	X	X	X							
Two Pipe Fan Coil Units	X	X	X	X	X										
Electric Radiation	X	X	X	X	X										
Heating/Ventilating Unit	X	X	X	X	X		X								
Direct Fired Furnace	X	X	X	X	X		X								
Steam Unit Heater					X										
Hot Water Unit Heater					X										
Steam Radiation					X										
Hot Water Radiation	X	X	X	X	X										
Steam Boiler									X						
Hot Water Boiler										X					
Steam/Hot Water Converter	X	X	X		X					X					
Air Cooled DX Compressor	X	X	X	X											
Air Cooled Chiller	X	X									X	X			
Water Cooled Chiller											X	X	X	X	
Lighting Control															X

In most instances, prudent engineering practices have been followed in determining appropriate control strategies for each specific piece of equipment.

- AHU's and ventilating units that are required to maintain ventilation rates will not have duty cycling or demand limiting applied.
- AHU's that are the only source of heat to a space will not have the scheduled start/stop strategy applied. The start/stop strategy shuts-down the equipment totally in unoccupied periods. For spaces that need to maintain a setback temperature, the day/night setback strategy was used which allows the unit to cycle on and off.
- The day/night setback strategy will be the only strategy applied to fan coil units since they are required to maintain building temperature. This will be accomplished by cycling the pump to maintain a reduced space temperature. In order to utilize the first four strategies for fan coil units, each fan coil would have to be started/stopped individually or in banks of units by the UMCS. The great amount of fan coil units in buildings that utilize fan coils for conditioning and the cost to connect the UMCS to each fan coil unit will not be offset by the energy savings. Also the fan coils are the main source of heat for the building and could not be simply shutdown in the unoccupied cycle (schedule start/stop, optimum start/stop strategies). The motor load for even the largest building is too small to effectively apply demand limiting and duty cycling.
- The first four strategies listed in Table 2.6.1 will not be applied to radiation and unit heaters since these units are required to maintain heat in the building.
- Boiler selection control strategy will only be applied to large boilers. The strategy requires a large point count to apply and larger savings is required to obtain a good payback.
- The lighting control strategy will be applied to all administrative buildings, but not to supervised buildings. Supervised buildings are

defined as buildings that are supervised by an individual or individuals, such as recreation buildings, retail stores, libraries, etc. The lighting strategy will not be applied to residence buildings since these are occupied 24 hours with individual rooms.

### **2.6.2 Scheduled Start/Stop**

The scheduled start/stop program consists of starting and stopping equipment based on the time of day and day of week. Scheduled start/stop is the simplest of all UMCS functions to implement. This program provides the best potential for energy conservation by turning off equipment or systems during unoccupied hours.

### **2.6.3 Optimum Start/Stop**

The scheduled start/stop program described above is refined by automatically adjusting the equipment operating schedule in accordance with space temperatures and outside air (OA) temperature. In the scheduled start/stop program, HVAC systems are started prior to occupancy to cool down or heat up the space on a fixed schedule independent of OA and space conditions. The optimum start/stop program automatically starts and stops the system on a sliding schedule. The program will adjust start/stop time by taking into account the thermal inertia of the structure, the capacity of the HVAC system to either increase or reduce space temperatures, OA conditions, and current space temperatures, using prediction techniques. These techniques determine the latest time for starting HVAC equipment to satisfy the space environmental requirements at the beginning of the occupied cycle, and determine the earliest time for stopping equipment at the day's end.

#### **2.6.4 Duty Cycling**

Duty cycling is defined as the shutting down of equipment for predetermined short periods of time during normal operating hours. This function is normally only applicable to HVAC systems. Duty cycling operation is based on the fact that HVAC systems seldom operate at peak design conditions. If the system is shut off for a short period of time, it has enough capacity to overcome the slight temperature drift which occurs during the shutdown period. Although the interruption does not reduce the energy required for space heating or cooling, it does reduce energy input to auxiliary loads such as fans and pumps. Systems are generally cycled off for some fixed period of time, typically 15 minutes out of each hour of operation. The off time period and its frequency must be program adjustable. Off times are decreased if space temperature conditions are not satisfied, or increased if space temperature conditions remain satisfied.

#### **2.6.5 Demand Limiting**

Demand limiting is accomplished by shedding electrical loads to prevent electrical demand from exceeding a peak value (target). This technique is used to reduce electrical costs where electric demand is a cost factor in the utility rate schedules. Peak demand values are established by the utility company using fixed demand intervals, sliding window intervals, and/or time of day schedules. Many complex schemes exist for reducing peak demand billings; however, all schemes continuously monitor power demand and calculate the rate of change of the demand value in order to

predict future peak demand using prediction techniques. The most commonly shed loads are HVAC systems.

#### **2.6.6 Day/Night Setback**

The energy required for heating or cooling during unoccupied hours is reduced by lowering the heating space temperature setpoint or raising the cooling space temperature setpoint. This applies only to facilities that do not operate 24 hours a day. Space temperature can be reduced from the normal winter inside design temperature to a lower space temperature during the unoccupied hours, during cooling the normal temperature setting is reset upwards to a temperature that is compatible with the space requirements.

#### **2.6.7 Economizer**

The use of an economizer cycle in air conditioning systems can be a cost effective conservation measure, depending on climatic conditions and the type of mechanical system. The economizer cycle utilizes OA to reduce the building's cooling requirements when the OA dry bulb temperature is less than the required mixed air temperature. As outdoor air temperature falls below return air temperature, the amount of outdoor air added to the air stream is increased. When outdoor air temperature falls to a low point the economizer cycle is discontinued.

#### **2.6.8 Ventilation and Recirculation**

The ventilation and recirculation program controls the operation of the OA dampers when the introduction of OA would impose an additional

thermal load during warm-up or cool-down cycles prior to occupancy of the building. This program is particularly useful in those facilities which maintain environmental conditions (such as electronic equipment installations) during building unoccupied periods. During unoccupied periods, the OA dampers remain closed. During building occupied cycles, the OA, return and relief dampers are under local loop control. During summer cool-down cycle operation, when the OA temperature is cooler than the space temperature, the OA and exhaust air dampers are opened, and the fans are energized. During winter warm-up cycle operation, when the OA temperature is warmer than space temperature, the OA and exhaust air dampers are opened and the fans are energized.

#### **2.6.9 Hot Deck/Cold Deck Temperature Reset**

The hot deck/cold deck temperature reset program is applied to dual duct systems and multi-zone HVAC systems. These systems utilize a parallel arrangement of heating and cooling surfaces, commonly referred to as hot and cold decks, for providing heating and cooling capabilities simultaneously. The hot and cold air streams are combined in mixing boxes or plenums to satisfy the individual space temperature requirements. In the absence of optimization controls, these systems mix the two air streams to produce the desired temperature. When the space temperature is acceptable, a greater difference between the temperatures of the hot and cold decks results in inefficient system operation. This program selects the areas with the greater heating and cooling requirements, and establishes the minimum hot and cold deck

temperature differentials which will meet the requirements, thus maximizing system efficiency.

#### **2.6.10 Reheat Coil Reset**

Terminal reheat systems operate with a constant cold deck discharge temperature. Air supplied at temperatures below the individual space temperature requirements is elevated in temperature by reheat coils in response to signals from individual space thermostats. The reheat coil reset program identifies the reheat coil with the lowest discharge temperature or the reheat coil valve closest to the closed position (the zone with the least amount of reheat required). The program then resets the cold deck discharge temperature upward until it equals the discharge temperature of the reheat coil with the lowest demand. Where humidity control is required, the program will prevent the cooling coil discharge temperature from increasing further when the maximum allowable space humidity setpoint is reached. For air conditioning systems, where reheat coils are not used, the program will reset the cold deck discharge temperature upward until the space with the greatest cooling requirement is just satisfied.

#### **2.6.11 Steam Boiler Selection**

The steam boiler selection program is designed to select the most efficient boiler in a multiple boiler plant to satisfy the heating load. Boiler operating data will be obtained from the manufacturer, or developed by monitoring fuel input as a function of the steam output. Determination of boiler efficiency also takes into account the heat

content of the condensate return and make-up water. Based on the efficiency curves, fuel input versus steam output, the boilers with the highest efficiency can be selected to satisfy the heating load. Boilers may be started manually by a boiler operator or automatically by EMCS depending on site requirements. Burner operating efficiency is monitored by measuring the O<sub>2</sub> or CO and flue gas temperature in each boiler flue.

#### **2.6.12 Hot Water Outside Air Reset**

Hot water heating systems, whether the hot water is supplied by a boiler or a converter, are designed to supply hot water at a fixed temperature. Depending on the system design, the hot water supply temperature may be reduced as the heating requirements for the facility decrease. A reduction in hot water supply temperature results in reduction of heat loss from equipment and piping. To implement this program, the temperature controller for the hot water supply is reset as a function of OA temperature.

#### **2.6.13 Chiller Selection**

The chiller selection program is implemented in chilled water plants with multiple chillers. Based on chiller operating data and the energy input requirements obtained from the manufacturer for each chiller, the program will select the chiller or chillers required to meet the load with the minimum energy consumption.



#### **2.6.14 Chilled Water Temperature Reset**

The energy required to produce chilled water in a reciprocating or centrifugal refrigeration machine is a function of the chilled water supply temperature. The refrigerant suction temperature is also a direct function of the supply water temperature; the higher the suction temperature, the lower the energy input per ton of refrigeration. Chilled water supply temperature is selected for peak design times; therefore, the supply temperature can be reset upward during non-peak design operating hours to the maximum which will still satisfy space cooling requirements.

#### **2.6.15 Condenser Water Temperature Reset**

The energy required to operate refrigeration systems is directly related to the temperature of the condenser water entering the machine. Heat rejection systems are designed to produce a specified condenser water temperature such as 85°F at peak wet bulb temperatures. Automatic controls are provided at some sites to maintain a specified temperature at conditions other than peak wet bulb temperatures. In order to optimize the performance of refrigeration systems, condenser water temperature is reset downward when OA wet bulb temperature will produce lower condenser water temperature. The reset schedule will incorporate the manufacturer's requirements governing acceptable condenser water range.

#### **2.6.16 Chiller Demand Limit**

Centrifugal water chillers are normally factory equipped with an adjustable control system which limits the maximum available cooling

capacity, thus, the power the machine can use. The method of accomplishing this function varies with the manufacturer of the chiller. The chiller percent capacity is obtained by monitoring the chiller current input.

#### **2.6.17 Lighting Control**

Time scheduled operation of lighting consists of turning lights off based on the time of day and/or the day of the week. Additional off commands may be generated at regular intervals to ensure that lights are off (relay operated zoned lighting only). The existing light switches will be changed to a current sensing type switch. The current sensing switch will sense a momentary power interruption at the lighting circuit breaker and physically unlatch the switch dropping it into the off position. When in the off position, the switch will be illuminated, allowing easy identification of the switch to manually override the lights. Refer to Attachment 8.6 for manufacturers information on these type of switches. Emergency lighting is not to be controlled by this program.

## 2.7 Btu/Unit

The following energy values have been used in the energy calculations in this report. These values are from the Institutional Conservation Program (ICP) as administered by DoE.

<b>Table 2.7</b> <b>Btu/Unit</b>	
Fuel Type	Btu/Unit
Natural Gas (mcf)	1,031,000
Distillate Fuel Oil (gal)	138,700
Electricity (kWh)	3,413

## 2.8 Building by Building UMCS Analysis and Base UMCS Analysis

An analysis will be produced for each building and a base analysis will be developed incorporating all applicable buildings in a single Energy Conservation Opportunity. The individual building analysis will be produced in order to determine which buildings are applicable. The analysis format consists of the following sections:

1	Existing Control Conditions
2	Proposed Control Strategies
3	Point list for Control Strategies
4	Construction Cost Estimates
5	Strategy Savings
6	Economics
7	Discussion

### **2.8.1 Existing Control Conditions**

A general description of the existing control points in the building or on the base. Most points are stated as being monitoring only points. This means that the existing Honeywell EMS is no longer capable of controlling the start/stop points and now only monitors whether the equipment is operating or not. It is not known how any of the points were originally controlled. The Fort Meade Department of Public Works (DPW) estimated that less than 25% of the existing EMCS is actually controlling equipment. Based on this knowledge it was agreed that in order to simplify the study, we would assume that the existing system has no energy savings capabilities.

### **2.8.2 Proposed Control Strategies**

The control strategies to be applied based on HVAC equipment in the building. The strategies are explained in Section 2.6 and are as described in the Energy Monitoring and Control Systems (EMCS) Manual (TM5-815-2, January 1991).

### **2.8.3 Point List for Control Strategies**

The amount of analog and digital control points required in order to initiate the applied control strategies. The points are based on industry standards and applications software described in the Energy Monitoring and Control Systems (EMCS) Manual (TM5-815-2, dated January 1991).

#### **2.8.4 Construction Cost Estimates**

The construction cost estimates prepared for this study are considered “conceptual” in nature. They are conceptual because they are based upon engineering design that is less than 1% of a complete design effort.

The cost estimates are broken down into material, labor, and engineering components. Calculations or a spreadsheet are usually provided with each alternative.

The final results of a project can vary significantly from the “conceptual” cost estimate. The American Association of Cost Engineers (AACE) generally states that an accuracy range of plus or minus 20% from the total estimated cost is possible. Variations beyond this range are possible for the stated scope, but not likely.

Since it is not possible for the consultants to know the most likely variations that can occur in the future, nor can it control certain technologies, contractors, or general economic conditions, the costs estimated herein should be not construed as fixed or precise. Rather, they are estimates which will require a great deal of effort to manage until the final costs are realized.

Costs are provided based on government cost the new draft edition of the UMCS Cost Estimator or actual quotes from the manufacturer of the existing EMCS system. The cost guideline states overhead, profit and

bond percentages to be used. These percentages will be as following:  
Overhead and Profit - 20% and Bond - 1.25%.

### **2.8.5 Annual Energy Savings**

This division of the analysis summarizes the anticipated energy savings as calculated in the ESA or EZDOE programs based on the UMCS strategies. Existing heating and cooling equipment efficiencies used for energy savings calculations varied from building to building depending on equipment age, type and usage. In general efficiencies used are as follows:

Heating	Effic.	Cooling	kW/ton
Hot Water Boiler	75%	Air Cooled Chiller	1.3
Central Steam System, large	65%	Water Cooled Recp. Chiller	1.0
Steam Boiler	75%	Water Cooled Control Chiller	0.7
		DX Systems	1.5

### **2.8.6 Economics**

Simple payback and savings to investment ratio (SIR) are calculated using LCCID (refer to Section 2.9).

### **2.8.7 Discussion**

The expected simple payback period from the analysis is noted. Any additional benefits or concerns are noted in this section along with a recommendation if the building should be included in the summary analysis.

## 2.9 Life Cycle Cost Analysis Summary

The life cycle costs were forecasted with Blast: LCCID Version 1.0, Level 80 Program. LCCID is an economic analysis computer program tailored to the needs of the Department of Defense (DoD).

It is intended to be used as a tool in evaluation and ranking of design alternatives for new and existing buildings. LCCID has built-in calculation procedures recognized as a standard for the DoD. The following is the specific criteria and other guidance embodied in LCCID according to the users' manual:

1. Office of Management and Budget (OMB) Circular A-94, March 27, 1972. OMB Circular A-94 has a new version (October 29, 1992) but a final decision on incorporating the new circular into tri-service criteria has not been determined.
2. Code of Federal Regulations, 10 CFR 436A, January 25, 1990. Annual fuel escalation rates are published by NIST (National Institute of Standards and Technology) under sanction by DoE.
3. Memorandum of Agreement on Criteria/Standards for Economic Analysis/Life Cycle Costing for MILCON Design, 18 March 1991. This memorandum obviated the need for separate criteria in the three services (Army, Air Force, and Navy) of the Department of Defense.
4. DoD Energy Conservation Investment Program (ECIP) Guidance. This guidance uses the memorandum from Item 3, as its basis, but also has

some qualifying factors for energy conservation projects and specifies its own format.

The LCCID program is structured as shown on Table 2.9.1, ECIP Study LCCID Ready Reference, which can be found at the end of this section. This table was obtained from the LCCID program users' manual.

The following criteria was selected/entered into the LCCID Program to obtain the Life Cycle Cost Analysis Summaries prepared as part of each alternative:

1. Common criteria selected for all life cycle cost analysis summaries:

- A. Military Construction Army
- B. User Entry of Consumption Values
- C. ECIP Project
- D. Energy Escalation Rates for FY94
- E. English Units

2. Common criteria entered into all life cycle cost analysis summaries:

- A. ECIP Economic Life: Ten years
- B. Location: Washington, D.C.
- C. Electric Usage Cost: Varies per project
- D. Project Number: 4130.07
- E. Fiscal Year: 1995
- F. Project Title: UMCS
- G. Installation Name: Fort George G. Meade
- H. Study Preparer: Entech Engineering, Inc.
- I. Salvage Value: \$0

3. Criteria entered into life cycle cost analysis summaries from the alternative:



- A. Discrete Portion Title: Alternative
- B. Construction Cost: Dollars
- C. Design Cost: Program default of 6% of construction cost
- D. Supervision, Inspection, and Overhead (SIOH): Program default of 5.5% of construction
- E. Energy Savings: mmBtu
- F. Demand Savings: Annual Dollars
- G. Annual Recurring Savings: Maintenance Savings Alternative Section
- H. Non-Recurring Savings: Maintenance Savings Alternative Section

A sample Life Cycle Cost Analysis Summary Report is shown in Table 2.9.2 located at the end of this section. In this example, all the common criteria, noted in 2.9 Items 1 and 2, was selected or entered into this summary report.

In Part 1 of the summary report, a construction cost of \$10,000 was assumed. The Design Costs and SIOH were calculated by the program at \$600 (6.0%) and \$550 (5.5%) respectively.

In Part 2 of the summary report, an electric energy saving of 500 mmBtu/yr was assumed. A \$500/yr demand savings show in "2M" was also assumed.

In Part 3 of the summary report, a maintenance savings of \$100/yr was also assumed. In the actual summary reports, the above-assumed numbers would originate from an alternative. In this example, the program calculated a simple payback of 2.8 years and a savings to investment ratio of 6.50.

## **2.10 Draft Report/Client Review/Final Report**

After the previous sections have been substantially completed, Entech proceeds to compile the information into the report format: Entech schedules a meeting with the client to present its findings. A copy of the report is supplied to the client for a more detailed review.

Entech then proceeds to incorporate the clients review comments and produce a final report.

Table 2.9.1

HELP or @ - To STOP how the question pertains to LCC and to hints on allowable answers.  
 LIST or ? - To Display a LIST of allowable inputs.  
 TEACH - To begin seeing all the help messages before entering your response.  
 SAVE - To save the Study File from any prompt.  
 ABORT or QUIT - To TERMINATE the program without saving any information since the last SAVE or Auto-save.

# ECIP STUDY ~ LCCID READY REFERENCE

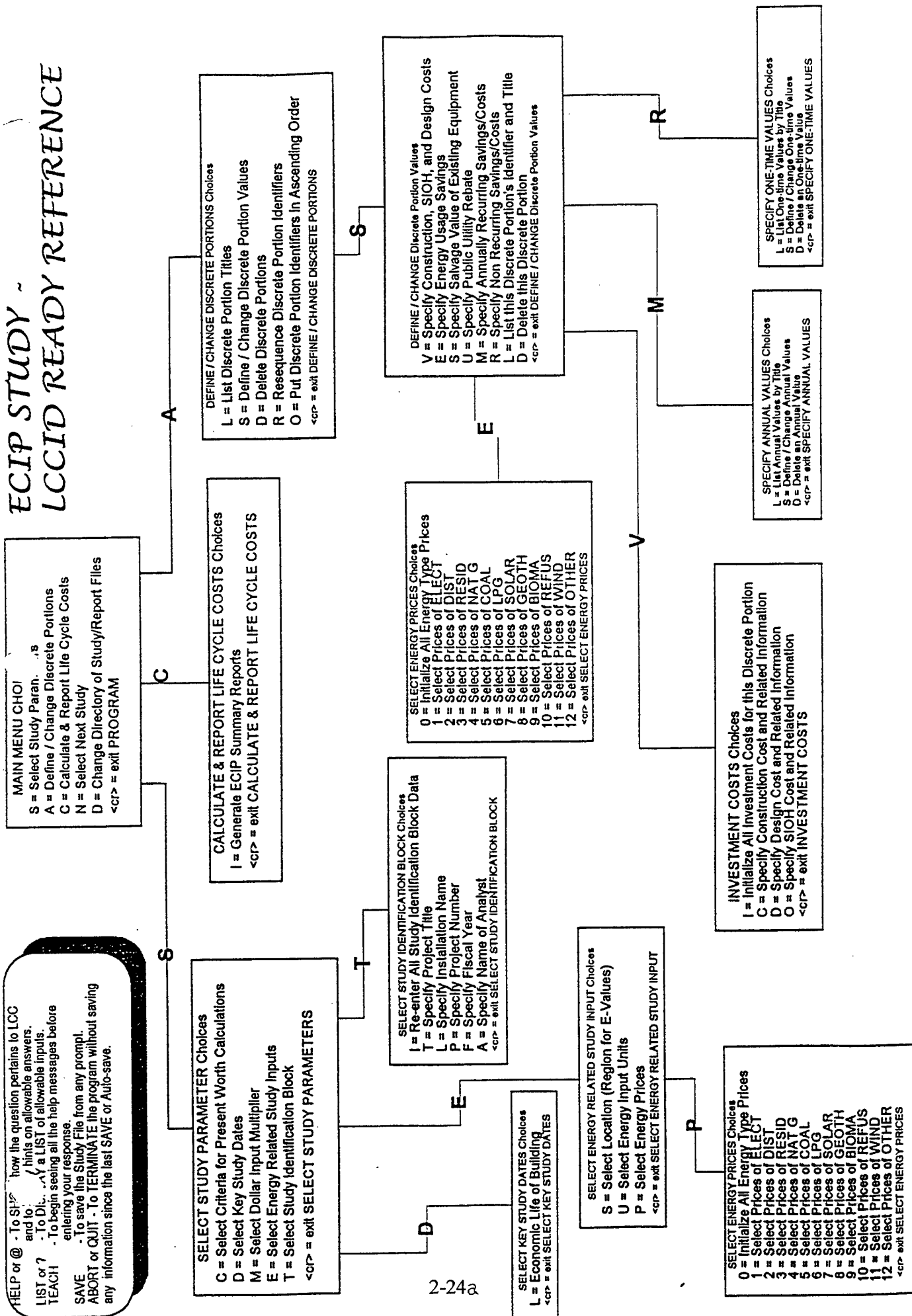


Table 2.9.2

LIFE CYCLE COST ANALYSIS SUMMARY  
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) STUDY: MEADE4  
 INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 LCCID FY95 (92)  
 PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY CENSUS: 3  
 FISCAL YEAR 1996 DISCRETE PORTION NAME: SAMPLE  
 ANALYSIS DATE: 05-28-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

## 1. INVESTMENT

A. CONSTRUCTION COST	\$	10000.		
B. SIOH	\$	550.		
C. DESIGN COST	\$	600.		
D. TOTAL COST (1A+1B+1C)	\$	11150.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		11150.	

## 2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	7.	\$ 68.	8.18	\$ 559.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	0.	\$ 0.	9.51	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		7.	\$ 68.		\$ 559.

## 3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	400.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	3228.

## B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 3228.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 468.

5. SIMPLE PAYBACK PERIOD (1G/4) 23.81 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 3787.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .34$   
 (IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

### **3.0 FACILITY DESCRIPTION**

#### **3.1 General**

Fort George G. Meade (Fort Meade) is located approximately mid-distance between Baltimore, Maryland and Washington, D.C. The base was established in 1917 and has been in continuous use since that time. Fort Meade is an administrative post for the Military District of Washington and provides a place for federal personnel to work and live. Fort Meade provides a base operations to support tenant activities which include all service branches, Department of Defense activities and federal agencies. Fort Meade includes approximately fifteen hundred (1,500) buildings and encompasses 5,408 acres. Fort Meade houses numerous support facilities for education, administration, maintenance, medical, recreation, mercantile, and personal housing.

#### **3.2 Building Descriptions**

(Table 3.1)

#### **3.3 Existing Base EMCS System**

The existing EMCS is a Honeywell Delta-1000 system. The system is an analog based control system and was installed in 1977. The system software was updated five years ago and field hardware improvements were made in 1982. There are currently 780 points encompassing 76 buildings connected to the system via phone lines. Many of the points are no longer functioning and some buildings have been deleted from the system.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING FACILITY DATA  
TABLE 3.1**

Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
370	19,583	NCO Club	Not in use	2	Stucco and concrete block and a shingled roof	Four AHU's heat and cool the building, each with a steam coil and a DX coil. Air cooled DX chiller and gas fired steam boiler.	
375	8,120	Post Mailroom and Warehouse	Monday-Friday 7 - 6	1	Metal siding and a metal roof	Gas fired furnace heats the mailroom and gas fired unit heaters heat the warehouse. A separate air conditioning unit cools the mailroom.	
393	10,368	Administrative	Not in use	1	Concrete block walls with a flat built-up roof	Gas fired furnace for heating the building and a 46 ton air conditioning unit for cooling.	
504	20,580	Training Aide Center	Monday - Friday 8 - 5 To be abandoned	1	Wood frame building with vinyl siding and a shingled roof	Gas fired steam boiler feeding steam unit heaters heat most of building. A cooling only packaged AHU cools the office area.	
909	23,000	Youth Center	Tuesday - Thursday 8 - 8 Friday 8 - 7 Saturday 12 - 7	1	Brick and block walls with a standing seam metal roof	Four AHU's heat and cool the building, one each for the lobby, gym, classrooms, and office/game areas. Each unit has a DX coil and HW coil. A dedicated DX condenser serves each unit. Gas fired steam boiler with a converter provides the heat. Office and classrooms have perimeter HW baseboard radiation.	

Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
940	31,720	Morale Support Office	Monday - Friday 7 - 6	1	Wood frame building with wood siding and a shingled roof	Office area conditioned by an AHU with steam coil and DX coil with outdoor condenser. Rest of building heated only by steam unit heaters. Oil fired steam boiler.	
1976	11,724	Warehouse	Monday - Friday 7 - 6	1	Concrete block with a built-up roof	Steam unit heaters with steam supplied from building 1978 heat the building.	
1978	43,547	Administrative	Monday - Friday 7 - 6	1	Concrete block with a flat built-up roof	Two VAV AHU's heat and cool most of building with one single zone AHU serving the southwest corner. Gas fired steam boiler. Air cooled DX chiller dedicated to each AHU.	
2212	9,058	Administrative	Monday - Friday 7 - 6	2	Wood frame building with vinyl siding and a shingled roof	Two AHU's cool the building in the summer with a DX air cooled condenser. Electric radiation heats the building. A separate heat pump unit serves the executive offices.	
2220	11,520	Guided Missile Maintenance Facility	Monday - Friday 7 - 6	1	Concrete block and metal siding walls with a built-up roof	Oil fired steam boiler to supply steam unit heaters and a packaged office AHU with DX cooling. Window A/C units cool a second office.	
2234	25,162	Administrative	Monday - Friday 7 - 6	3	Brick and concrete block walls with a shingled roof	Two pipe fan coils heat and cool the building with no outdoor air. Gas fired hot-water boiler provides hot water and a 100-ton air cooled chiller provides chilled water.	

Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
2251	3,594	Heat Plant	Not in use	1	Wood frame building with metal siding and a metal roof	Four steam boilers supplied steam to a few buildings.	Building is out of service
2253	18,912	DS Vehicle Maintenance Shop	Monday - Friday 7 - 6	1	Wood frame building with vinyl siding and a shingled roof	Gas fired furnace heats the building. No cooling in building.	
2257	51,712	Administrative	Monday - Friday 7 - 6	4	Brick and block walls with a shingled roof	Two-pipe ceiling mounted fan coil units condition building. Basement 100% outdoor air unit supplies fresh air to each floor. Two gas fired hot water boilers and a 90 ton air cooled chiller provides hot and chilled water.	
2282	22,796	Administrative R&D	60 hours per week	1	Concrete block building with a built-up roof	Two-pipe system of AHU's and fan coils heat and cool the building. Gas fired hot water boiler and two 20 ton air cooled chillers provide hot and chilled water.	
2481	17,436	UEPH	24 hrs/day 7 days/week	2	Brick and block walls with a built-up roof	Multi-zone AHU with DX coil cold deck and hot water hot deck. Fin tube radiation for skin loss. 30 ton DX condensing unit.	Steam supplied from Building 2482
2482	3,414	Heat Plant	24 hrs/day 7 days/week	1	Brick and block walls with a built-up roof	Three 400 BHP oil fired boilers provide 90 psi steam to buildings 2481, 2490, 2484 and the Hospital 2480.	
2484	18,185	Medical Supply Warehouse	Monday - Friday 7 - 6	1	Steel frame building with metal siding and a metal roof	Steam unit heaters heat the warehouse area. AHU's with DX coil and steam coil heat and cool each office area.	Steam supplied from Building 2482



Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
2490	34,144	Laboratory	Monday - Friday 7 - 6	4	Brick and block walls with a built-up roof	Three AHU's condition the building with 100% outdoor air. Each unit has a CHW coil and a steam preheat and reheat coil. AHU-1 serves the first and 2nd floors, AHU-2 serves the basement, and AHU -3, a multi-zone unit, serves the 3rd floor. Two 135 ton centrifugal chillers with a single 270 ton cooling tower provides chilled water.	Steam supplied from Building 2482
2501	14,754	Administrative	Monday - Friday 7 - 6	1	Wood frame building with vinyl siding and a shingled roof	Two gas fired furnaces heat the building. Cooling only AHU's cool the office areas with a DX coil and outdoor condensing unit.	
2786	118,000	Commissary	Monday - Friday 8 - 7 Saturday 8 - 5	1	Brick and block walls with a ballasted rubber roof	AHU's with hot water heat and DX cooling serve the retail, office, and warehouse areas. Rooftop DX condensing unit for each AHU. Gas hot water boiler. Two-pipe ceiling unit ventilators above the cashier area for heating only.	
2789	8,988	Post Office	Monday - Saturday 7 - 6	1	Brick and block walls with a built-up roof	Two AHU heat and cool the building with a hot water coil and DX coil. Condensing units on roof. Gas fired hot water boiler provides hot water.	
2790	78,343	Main Exchange, Retail	Monday - Friday 9 - 7 Saturday 8 - 5	2	Brick and block walls with a built-up roof	Eight rooftop packaged units heat and cool the main retail space. Nine rooftop packaged units heat and cool individual retail and office areas. Each packaged unit has DX cooling and gas heating.	

Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
2793	26,246	Guest Housing	24 hrs/day 7 days/week	2	Brick and frame walls with a shingled roof	An electric package terminal unit for heating and cooling each room.	Motel
2812	4,720	Administrative	Monday - Friday 7 - 6	2	Wood frame building with wood siding and a shingled roof	Gas fired furnace to heat and cool building with a separate DX coil and condensing unit for each floor.	
3000	10,883	FE Facility	Monday - Friday 7 - 6	1	Wood and steel frame building with metal siding and a shingled roof	Single AHU heats and cools building with steam coils and a DX coil. 50 ton DX chiller and gas fired steam boiler.	
4215	74,059	Administrative	Monday - Friday 7 - 6	4	Brick and block walls with shingled roof	Two-pipe fan coil units with gas hot water heat and a 125 ton air cooled chiller.	No outdoor air to fan coils
4216	37,244	Administrative	Monday - Friday 7 - 6	4	Brick and block walls with shingle roof	Two pipe fan coil units with gas hot water heat and a 60 ton air cooled chiller.	No outdoor air to fan coils
4217	34,548	Administrative	Monday - Friday 7 - 6	4	Brick and block walls with shingled roof	Two pipe fan coil units with gas hot water heat and a 60 ton air cooled chiller.	No outdoor air to fan coils
4411	39,379	Administrative	Monday - Friday 7 - 6	4	Brick and block walls with a shingled roof. The enclosed porch areas are wood frame and vinyl siding	Five AHU's heat and cool the building. One per floor with two units in the basement. Each unit is a single zone unit with dual temp HW and CHW coil. The building is a two pipe system. Two pipe fan coil units serve the third floor porch areas. Two gas fired HW boilers and one 95 ton air cooled chiller provides hot and chilled water.	

Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
4418	7,953	Library	Tuesday - Saturday 11 - 6	1	Brick and block walls with a shingled roof	Single AHU cools the building with a DX coil and a 15 ton air cooled condenser. Hot water fin tube radiation heats the building and hot water is produced by a oil fired boiler.	
4419	10,290	Post Chapel	12 hrs - Sunday 12 hrs - rest of week	3	Brick and block walls with a shingled roof	5 AHU's heat and cool the building with gas steam heat and a 50 ton air cooled chiller.	
4431	5,812	Theater w/Dressing Room	40 hrs per week	2	Brick and block walls with a slate roof	Single AHU heats and cools the building with gas steam heat and 30 tons of DX cooling.	
4432	18,640	Administrative	Monday - Friday 7 - 6	1	Brick and block walls with a built-up roof	Two AHU's with DX cooling and HW heat and small split system unit with DX cooling and electric heat condition the building. HW fin tube radiation on perimeter. Gas fired hot water boiler provides hot water.	
4471	7,248	ACAP/Credit Union	50 hrs per week	1	Stucco and block walls with a shingled roof	Oil fired hot air furnace heats in winter and cools in summer with two DX air cooled condensers.	
4550	123,400	Administrative	Monday - Friday 7 - 6	4	Brick and block walls with a flat rubber roof	Two multi-zone AHU's per floor, except 4th, which has a single unit. Each unit with a hot water hot deck and a CHW cold deck coil. Two gas fired hot water boilers and two air cooled chillers on 4th floor provide hot and chilled water.	

Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
4551	13,614	Administrative	Monday - Friday 7 - 6	3	Brick and block walls with a slate roof	Two multi-zone units serve the center of the first floor and one multi-zone unit serves the center of the second floor. Each unit with a dual temp coil. Small split system heat pump for conference room. Two pipe fan coil units condition each end of each floor of the building. Gas fired HW boiler and 50 ton air cooled chiller provide hot and chilled water.	
4552	87,824	Administrative	Monday - Friday 7 - 6	5	Brick and block walls with a slate roof	Seven AHU's heat and cool the building. Five of the units are packaged units with DX cooling and steam coils with three units being multi-zone and two units single zone. Outdoor condensing unit for each packaged unit. Two units are single zone AHU's with chilled water coils and steam coils. Two 30 ton air cooled chillers serve these two units. Two gas fired steam boilers in the basement.	
4553	103,938	Administrative	Monday - Friday 7 - 6	4	Brick and block walls with a slate roof. The enclosed porch and walls are wood frame and wood siding	Nine packaged AHU's serve the building. Two per floor with a third unit serving part of the 1st floor. Each packaged unit has a DX coil, HW coil and a dedicated outdoor condensing unit. Two gas fired how water boilers in basement.	

Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
4554	95,730	Administrative	Monday - Friday 7 - 6	5	Brick and block walls with a slate roof. The enclosed porch areas are wood frame and wood siding	Eleven packaged AHU's serve the building. Two per floor with a third unit serving part of the second floor. Each packaged unit has a DX coil, HW coil, and a dedicated outdoor condensing unit. Two gas fired boilers in the basement. The enclosed porch areas are heated by packaged terminal air conditioning units with HW coils.	
4587	11,440	Exchange Service Outlet	Monday - Saturday 9 - 5	1	Brick and block end walls and stucco and block front and rear walls with a shingled roof	Four oil fired furnaces heat the garage area and an oil fired furnace with DX cooling conditioning the office.	
4675	1,710	Exchange Service Outlet	Monday - Friday 8 - 5 Saturday - 8 - 2	1	Metal frame building with metal walls and roof	A heat pump conditions building with supplemental electric heat and an outdoor condensing unit.	
4680	4,174	Exchange Service Station	7 days/week 7 - 7	1	Brick walls and a shingled roof	Four hot water unit heaters heat the garage fed by an oil fired hot water boiler. Split system AHU heats and cools office with HW coil and DX coil.	
4700	36,819	Band Training Facility	Monday - Friday 7 - 4	3	Wood frame building with vinyl siding and a shingled roof	Band rehearsal room heated and cooled by an AHU with a steam coil and DX coil with outdoor condenser. Other areas cooled by a packaged or split system DX cooling unit and are heated by perimeter steam radiation. Gas fired steam boiler provides steam.	

Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
4703	14,878	Officers Qtrtrs	24 hrs/day 7 days/week	2	Block walls and a built-up roof	Two pipe fan coil units in each room with no outside air. Gas fired HW boiler and a 20 ton air cooled chiller.	
4704	14,878	Officers Qtrtrs	24 hrs/day 7 days/week	2	Block walls and a built-up roof	Two pipe fan coil units in each room with no outside air. Gas fired HW boiler and a 20 ton air cooled chiller.	
4705	24,850	Officers Qtrtrs	24 hrs/day 7 days/week	3	Block walls and a built-up roof	Two pipe fan coil units in each room with no outside air. Gas fired HW boiler and a 40 ton air cooled chiller.	
4707	24,850	Officers Qtrtrs	24 hrs/day 7 days/week	3	Block walls and a built-up roof	Two pipe fan coil units in each room with no outside air. Gas fired HW boiler and a 40 ton air cooled chiller.	
4709	24,850	Officers Qtrtrs	24 hrs/day 7 days/week	3	Block walls and a built-up roof	Two pipe fan coil units in each room with no outside air. Gas fired HW boiler and a 40 ton air cooled chiller.	
4717	13,536	Officers Qtrtrs	24 hrs/day 7 days/week	2	Block walls with a built-up roof	Two pipe fan coil units in each room with no outdoor air.	
4720	12,689	Officers Qtrtrs	24 hrs/day 7 days/week	2	Block walls with a built-up roof	Two pipe fan coil units in each room with no outdoor air.	Hot water boiler and 60 ton air cooled chiller in 4720, serves 4720, 4717, and 4721
4721	13,824	Officers Qtrtrs	24 hrs/day 7 days/week	2	Block walls with a built-up roof	Two pipe fan coil units in each room with no outdoor air.	

Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
6330	41,900	Physical Fitness Center	Monday - Friday 13 hrs/day  Saturday - Sunday - Holiday 8 hrs/day	2	Block walls with a built-up roof	The gym is heated and ventilated only by a single AHU with a HW coil. The basement, pool and remaining areas are heated and ventilated only by a single AHU with a HW coil. Office areas have cooling only packaged terminal units. Reheat coils provided for remote areas. Two gas fired hot water boilers.	
6530	18,300	Skill Development Center	90 hours per week	1	Concrete block walls with built-up roof	AHU's heat and cool the craft area and office areas of the buildings with HW coils and DX coils. Outdoor condensing units are dedicated to each AHU. HW unit heaters heat the garage area and a HW coil heat and ventilating unit ventilates the garage area. Gas fired hot water boiler.	
6600	23,552	Open Dining, Officer Club	40 hrs/week days and evenings	1	Brick and block walls with a built-up roof	Nine AHU's heat and cool the building. One unit for each individual space. Each unit has a CHW and HW coil. Two gas fired hot water boilers and an air cooled 100 ton chiller provide hot and chilled water. Fan coil units condition small offices and lobbies.	
6800	12,800	Golf Clubhouse	Daily 6 - 8	2	Brick and block walls with sloped roofs shingled and flat roofs rubber	Five rooftop package VAV units condition the building with gas heat.	

Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
7100	30,503	Chapel Center Facility	40 hrs per week	1	Brick and block walls with a shingle roof	Two pipe unit ventilators heat and cool all spaces. Gas hot water boiler and a 120 ton air cooled chiller provide hot and chilled water.	
8452	27,448	Administration (Rec. Center)	Monday - Friday 7 - 6	1	Concrete block walls with a rubber roof	Two AHU's heat and cool gym with HW and DX coil and an outdoor condenser. The lobby/office and snack bar areas are each cooled by an AHU with HW and DX coil with outdoor condenser. Steam to HW converter.	Steam supplied from Building 8481
8465	9,587	Post Chapel	12 hrs Sunday 12 hrs rest of week	1	Concrete block walls with a built-up roof	AHU with CHW coil and steam coil for chapel and two-pipe unit vents for office and classrooms. Water cooled 40 ton chiller.	Steam supplied from Building 8481
8472	10,000	Dental Clinic	Monday - Saturday 7 - 6	1	Concrete block walls with a built-up roof	Multi-zone AHU with steam hot deck and CHW cold deck coils 60 ton air cooled chiller.	Steam supplied from Building 8481
8476	3,344	Battalion Headquarters Building	70 hours per week	1	Concrete block walls with a built-up roof	AHU with DX coil and steam coil heats and cools building. 15 ton air cooled condenser outside.	Steam supplied from Building 8481
8477	3,504	Battalion Headquarters Building	70 hours per week	1	Concrete block walls with a built-up roof	AHU with DX coil and steam coil heats and cools building. 15 ton air cooled condenser outside.	Steam supplied from Building 8481
8478	38,490	UEPH	24 hrs/day 7 days/week	4	Concrete block walls with built-up roof	Two pipe ceiling fan coil unit in each room with basement 100% outside air unit. 50 ton air cooled chiller. Rooftop packaged AHU for front office/day room/mess hall areas.	Steam supplied from Building 8481



Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
8479	38,490	UEPH	24 hrs/day 7 days/week	4	Concrete block walls with built-up roof	Two pipe ceiling fan coil unit in each room with basement 100% outside air unit. 50 ton air cooled chiller. Rooftop packaged AHU for front office/day room/mess hall.	Steam supplied from Building 8481
8481	7,718	Heat Plant	24 hrs/day 7 days/week	1	Concrete block walls with	Two 700 BHP boilers and one 175 BHP boiler supply 70 psi steam to 22 buildings.	
8485	4,864	ORG Vehicle Maintenance Shop	Monday - Friday 7 - 5	1	Concrete block walls with shingled roof	Oil fired hot air furnace. No cooling.	
8486	4,864	ORG Vehicle Maintenance Shop	Monday - Friday 7 - 5	1	Concrete block walls with shingled roof	Oil fired hot air furnace. No cooling.	
8544	38,490	UEPH	24 hrs/day 7 days/week	4	Concrete block walls with built-up roof	Two pipe ceiling fan coil unit in each room with basement 100% outside air unit. 50 ton air cooled chiller. Rooftop packaged AHU for front office/day room/mess hall areas.	Steam supplied from Building 8481
8545	38,490	UEPH	24 hrs/day 7 days/week	4	Concrete block walls with built-up roof	Two pipe ceiling fan coil unit in each room with basement 100% outside air unit. 50 ton air cooled chiller. Rooftop packaged AHU for front office/day room/mess hall areas.	Steam supplied from Building 8481
8605	38,490	UEPH	24 hrs/day 7 days/week	4	Concrete block walls with built-up roof	Two pipe ceiling fan coil unit in each room with basement 100% outside air unit. 50 ton air cooled chiller. Rooftop packaged AHU for front office/day room/mess hall areas.	Steam supplied from Building 8481

Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
8606	38,490	UEPH	24 hrs/day 7 days/week	4	Concrete block walls with built-up roof	Two pipe ceiling fan coil unit in each room with 100% AHU for 2nd and 3rd floors and AHU for offices. 50 ton air cooled chiller. Rooftop packaged AHU for front office/day room /mess hall areas.	Steam supplied from Building 8481
8607	38,490	UEPH	24 hrs/day 7 days/week	4	Concrete block walls with built-up roof	Two pipe ceiling fan coil unit in each room with basement 100% outside air unit. 50 ton air cooled chiller. Rooftop packaged AHU for front office/day room/mess hall areas.	Steam supplied from Building 8481
8609	38,490	UEPH	24 hrs/day 7 days/week	4	Concrete block walls with built-up roof	Two pipe ceiling fan coil unit in each room with basement 100% outside air unit. 50 ton air cooled chiller. Rooftop packaged AHU for front office/day room/mess hall areas.	Steam supplied from Building 8481
8610	38,490	UEPH	24 hrs/day 7 days/week	4	Concrete block walls with built-up roof	Two pipe ceiling fan coil unit in each room with basement 100% outside air unit. 50 ton air cooled chiller. Rooftop packaged AHU for front office/day room/mess hall areas.	Steam supplied from Building 8481
8611	38,490	UEPH	24 hrs/day 7 days/week	4	Concrete block walls with built-up roof	Two pipe ceiling fan coil unit in each with basement 100% outside air unit. 50 ton air cooled chiller. Rooftop packaged AHU for front office/day room/mess hall areas.	Steam supplied from Building 8481

Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
9801	80,550	UEPH	24 hrs/day 7 days/week	3	Brick and block walls with a built-up roof	Two pipe ceiling mounted fan coils for each room. Two AHU's supply 100% outside air to each floor. A multi-zone unit conditions the day room/office areas. Steam to water converter. 200 ton chiller serves 9801-9802.	Steam supplied from Building 9807
9802	80,550	UEPH	24 hrs/day 7 days/week	3	Brick and block walls with a built-up roof	Two pipe ceiling mounted fan coils for each room. Two AHU's supply 100% outside air to each floor. A multi-zone unit conditions the day room/office areas steam to water converter.	Steam supplied from Building 9807
9803	80,550	UEPH	24 hrs/day 7 days/week	3	Brick and block walls with a built-up roof	Two pipe ceiling mounted fan coils for each room. Two AHU's supply 100% outside air to each floor. A multi-zone unit conditions the day room/office areas steam to water converter. 200 ton chiller serves 9803-9804.	Steam supplied from Building 9807
9804	80,550	UEPH	24 hrs/day 7 days/week	3	Brick and block walls with a built-up roof	Two pipe ceiling mounted fan coils for each room. Two AHU's supply 100% outside air to each floor. A multi-zone unit conditions the day room/office areas steam to water converter.	Steam supplied from Building 9807

Building #	Building Square Footage	Building Use	Building Occupancy	# Floors	Building Construction	Building HVAC Systems	Comments
9810	22,287	Rec. Center	Monday - Friday 13 hrs/day Saturday - Sunday 8 hrs/day	1	Brick and block walls with a built-up roof	Two AHU serve the gym with HW and CHW coils. The administrative and weight rooms are served by a single AHU with HW and CHW coils and a return fan. The PX is served by a single AHU with HW and CHW coils steam to water converter and 20 ton air cooled chiller provide hot and chilled water.	Steam supplied from Building 9807
9827	68,061	UEPH	24 hrs/day 7 days/week	3	Brick and block walls with a built-up roof	Two pipe floor mounted fan coil units in each room with outdoor air. Steam to water converter and 100 ton water chiller with a cooling tower provide hot and chilled water.	Steam supplied from Building 9807
9828	128,393	UEPH	24 hrs/day 7 days/week	3	Brick and block walls with a built-up roof	Two pipe ceiling mounted fan coil units in each room. 100% outdoor air AHU's for each floor, steam to water converter, 180 ton water chiller with cooling tower.	Steam supplied from Building 9807
9829	16,905	Enlisted Personnel Dining	Daily 5 - 8	1	Brick and block walls with a built-up roof	Two packaged rooftop units with gas heating serve the dining area. Gas fired and steam heated makeup units serve the kitchen.	Steam supplied from Building 9807

## **4.0 ENERGY COSTS**

The following energy costs are derived from actual Fort Meade energy bills.

### **4.1 Electric Rates**

Baltimore Gas and Electric Company (BG&E) provides power to Fort George G. Meade under the schedule P rate (Primary Voltage Service). This rate is available to customers with demands greater than 1500 kW for general purposes.

#### **4.1.1 Incremental Cost**

Entech Engineering Inc. developed a Lotus spreadsheet computer program to determine the incremental cost for electricity. Using actual billing data, usage and demand are input into the program, and the bill is calculated. The computer calculation should match the utility's bill. The Fort Meade electric bill will be used for this calculation.

To calculate the incremental cost for billing demand, the electric bill is re-calculated using one less kW of demand. The cost difference between the actual bill and the bill calculated with one less kW is considered to be the incremental cost for demand (\$/kW). The January 1995 bill incremental was calculated using the current rate structure which has lower usage costs than the costs that were applicable in January.

The same procedure is performed for usage (kWh). The bill is calculated using one less kWh, with the difference in the two costs being the incremental usage cost (\$/kWh). For this facility, the incremental costs for electricity are as follows:

<b>Table 4.1.1.1 Incremental Costs</b>		
<b>Incremental</b>	<b>Winter (Oct-May)</b>	<b>Summer (Jun-Sept)</b>
Demand, \$/kW	\$5.99	\$12.09
Off-Peak, \$/kWh	\$0.025	\$0.028
Interm., \$/kWh	\$0.033	\$0.040
On-Peak, \$/kWh	\$0.036	\$0.051

The savings calculations from DOE and ESA programs do not easily break savings down into summer/winter time periods or off-peak, intermediate or on-peak time periods. Some savings can be intuitively divided between summer and winter, but not between the three daytime periods. Average incremental costs below will be used where the actual incremental costs cannot be applied.

Average Incremental Costs

Demand \$/kW	-	Year	=	\$96.28
Usage \$/kWh	-	Average year	=	\$0.032
Usage \$/mmBtu	-	Average year	=	\$9.38

The use of incremental rates is reasonably accurate for calculating cost savings due to small changes in demand and usage ( $\pm 25\%$ ) from existing levels. The use of incremental rates is less accurate in calculating cost savings with larger changes in demand and usage ( $> 25\%$ ) and tends to underestimate savings slightly (usually  $< 2\%$ ). However, for the convenience of calculating the feasibility of various options, the use of incremental rates for demand and usage is either accurate or slightly conservative (savings not overestimated) and is therefore prudent.

Copies of the calculations of the incremental cost and monthly electric bills are included in the following pages.

## 4.2 Natural Gas Rates

Natural gas is provided by Baltimore Gas and Electric (BG&E) under rate schedule C (General Service - non-interruptible). Table 4.2.1 below displays the gas incremental rates for three months during 1995. The average incremental cost of \$3.97/mcf will be applied to the appropriate strategy savings.

<b>Table 4.2.1</b> <b>Fort Meade Gas Rate</b>				
<b>Month</b>	<b>Usage (mcf)</b>	<b>Cost (\$)</b>	<b>\$ per mcf</b>	<b>\$ per mmBtu</b>
January 95	65561.6	\$256,415.68	\$3.91	\$3.79
March 95	50904.3	\$200,725.75	\$3.94	\$3.82
July 95	9137.0	\$37,112.80	\$4.06	\$3.94
<b>Average 1995</b>			<b>\$3.97</b>	<b>\$3.85</b>

### **4.3 Fuel Oil Rate**

Various buildings at Fort Meade utilize #2 fuel oil for heating. Some buildings can use fuel oil or natural gas. According to Fort Meade personnel, fuel oil for 1995 cost them \$0.62 per gallon (\$4.47 mmBtu). This rate is fixed for the entire year and will be used for energy savings calculations in the ECO's.



**DEPARTMENT OF THE ARMY  
FORT MEADE  
1995 ELECTRIC READINGS  
BALTIMORE GAS & ELECTRIC COMPANY  
Rate Schedule P - Primary Voltage Service**

**Winter Incremental Rates**

Incremental Demand Cost, \$/kW	\$5.99
On-Peak Incremental Usage Cost, \$/kWh	\$0.03555
Intermediate Incremental Usage Cost, \$/kWh	\$0.03335
Off-Peak Incremental Usage Cost, \$/kWh	\$0.02472

**Summer Incremental Rates**

Incremental Demand Cost, \$/kW	\$12.09
On-Peak Incremental Usage Cost, \$/kWh	\$0.05088
Intermediate Incremental Usage Cost, \$/kWh	\$0.04040
Off-Peak Incremental Usage Cost, \$/kWh	\$0.02766

**Winter Rates**

On-Peak - Between the hours of 7:00 AM and 11:00 AM, and the hours of 5:00 PM and 9:00 PM on weekdays  
Intermediate-Peak - Between the hours of 11:00 AM and 5:00 PM on weekdays  
Off-Peak - All times other than those defined for On-Peak and Intermediate-Peak rating periods

**Summer Rates**

On-Peak - Between the hours of 10:00 AM and 8:00 PM on weekdays  
Intermediate-Peak - Between the hours of 7:00 AM and 10:00 AM, and the hours of 8:00 PM and 11:00 PM on weekdays  
Off-Peak - All times other than those defined for On-Peak and Intermediate-Peak rating periods

**Riders**

Rider #5 - Air Conditioning Credit  
Rider #14 - Emergency Generation Credit  
Summer Credit \$7.87/kW  
Winter Credit \$2.04/kW

Baltimore Gas & Electric Company, P (Primary Voltage Service) Electric Rate Analysis  
**Prepared by Entech Engineering, Inc.**

Billing and Client Information

Client	Fort Meade
Billing Year	1995
Billing Period	January
# of Billing Days	32
Enter "1" for Oct-May, 0 for Jun-Sept	1
Rates Schedule in Effect	Winter

Demand and Usage Information

Supply Voltage	13,200
<b><i>Demand Measurements</i></b>	
On-Peak Demand (kW)	63,421
Maximum Demand (kW)	0
<b><i>Usage Measurements</i></b>	
On-Peak Period (kWh)	9,076,532
Intermediate Period (kWh)	7,228,506
Off-Peak Period (kWh)	23,940,642
Total (kWh)	40,245,680

Taxes and Special Adjustments

Fuel Rate Total Energy Charge	\$0.01227
Electric Environment Surcharge	\$1,000.00
<b><i>Credits</i></b>	
Rider #5 Air Conditioning Credit	\$0.00
Rider #14 Emergency Generation	(\$12,240.00)

**Baltimore Gas & Electric Company, P (Primary Voltage Service) Electric Rate Analysis**  
**Prepared by Entech Engineering, Inc.**

***Duplicated Electric Bill***

Customer Charge	1 Bill @	\$750.00	Per Bill =	\$750.00
<i>On-Peak Usage Charge</i>				
Base Rate Charge	9,076,532 kWh @	\$0.02328	Per kWh =	\$211,301.66
<i>Intermediate Usage Charge</i>				
Base Rate Charge	7,228,506 kWh @	\$0.02108	Per kWh =	\$152,376.91
<i>Off-Peak Usage Charge</i>				
Base Rate Charge	23,940,642 kWh @	\$0.01245	Per kWh =	\$298,060.99
<i>Demand Charges</i>				
Maximum Demand Charge	0 kW @	\$2.33	Per kW =	\$0.00
On-Peak Demand Charge	63,421 kW @	\$5.99	Per kW =	\$379,891.79
<i>Other Charges and Credits</i>				
Fuel Rate Total Energy Charge	\$0.01227 \$/kWh x	\$40,245,680	Subtotal =	\$493,814.49
Electric Envir Surcharge		\$1,000.00	Subtotal =	\$1,000.00
Rider #5 Air Conditioning Credit		\$0.00	Subtotal =	\$0.00
Rider #14 Emergency Generation		(\$12,240.00)	Subtotal =	(\$12,240.00)
<b>CURRENT PERIOD CHARGES</b>				<b>\$1,524,955.85</b>

***Calculated Incremental***

Incremental Cost Per kW	\$5.99
Incremental Cost Per On-Peak kWh	\$0.03555
Incremental Cost Per Intermediate kWh	\$0.03335
Incremental Cost Per Off-Peak kWh	\$0.02472

***Calculated Billing Statistics Based on Incremental Costs***

Demand Cost	\$379,891.79	Energy Cost	\$1,155,554.06
% Demand	24.9%	% Energy	75.8%

***Current Electric Tariff (Rate P)***

	Summer	Winter
Customer Charge (\$/Bill)	\$750.00	\$750.00
On-Peak Demand Charge (\$/kW)	\$12.09	\$5.99
Maximum Demand Charge (\$/kW)	\$2.33	\$2.33
On-Peak Usage Charge (\$/kWh)	\$0.03861	\$0.02328
Intermediate Usage Charge (\$/kWh)	\$0.02813	\$0.02108
Off-Peak Usage Charge (\$/kWh)	\$0.01539	\$0.01245

**Baltimore Gas & Electric Company, P (Primary Voltage Service) Electric Rate Analysis**  
**Prepared by Entech Engineering, Inc.**

***Electric Bill Calculation***

Calculation Description	Actual Billing	Demand, kW Minus 1 kW	On-Peak Usage Minus 1 kWh	Intermediate Minus 1 kWh	Off-Peak Minus 1 kWh
On-Peak Demand (kW)	63,421	63,420	63,421	63,421	63,421
Maximum Demand (kW)	0	0	0	0	0
On-Peak Usage (kWh)	9,076,532	9,076,532	9,076,531	9,076,532	9,076,532
Intermediate Usage (kWh)	7,228,506	7,228,506	7,228,506	7,228,505	7,228,506
Off-Peak Usage (kWh)	23,940,642	23,940,642	23,940,642	23,940,642	23,940,641
Total Usage (kWh)	40,245,680	40,245,680	40,245,679	40,245,679	40,245,679
<i>Breakdown Calculations</i>					
Billing On-Peak Demand (kW)	63,421	63,420	63,421	63,421	63,421
Billing Maximum Demand (kW)	0	0	0	0	0
On-Peak Usage (kWh)	9,076,532	9,076,532	9,076,531	9,076,532	9,076,532
Intermediate Usage (kWh)	7,228,506	7,228,506	7,228,506	7,228,505	7,228,506
Off-Peak Usage (kWh)	23,940,642	23,940,642	23,940,642	23,940,642	23,940,641
Total Usage (kWh)	40,245,680	40,245,680	40,245,679	40,245,679	40,245,679
<i>Cost Calculation</i>					
Customer Charge, \$	\$750.00	\$750.00	\$750.00	\$750.00	\$750.00
On-Peak kWh Base Rate Charge, \$	\$211,301.66	\$211,301.66	\$211,301.64	\$211,301.66	\$211,301.66
Intermediate kWh Base Rate Charge, \$	\$152,376.91	\$152,376.91	\$152,376.91	\$152,376.89	\$152,376.91
Off-Peak kWh Base Rate Charge, \$	\$298,060.99	\$298,060.99	\$298,060.99	\$298,060.99	\$298,060.98
On-Peak Demand Charge, \$	\$379,891.79	\$379,885.80	\$379,891.79	\$379,891.79	\$379,891.79
Maximum Demand Charge, \$	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<i>Other Charges</i>					
Fuel Rate Total Energy Charge, \$	\$493,814.49	\$493,814.49	\$493,814.48	\$493,814.48	\$493,814.48
Electric Environment Surcharge, \$	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00
<i>Discounts</i>					
Rider #5 Air Conditioning Credit	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Rider #14 Emergency Generation	(\$12,240.00)	(\$12,240.00)	(\$12,240.00)	(\$12,240.00)	(\$12,240.00)
Net Current Bill	\$1,524,955.85	\$1,524,949.86	\$1,524,955.81	\$1,524,955.81	\$1,524,955.82
Incremental/Penalties	n/a	\$5.99	\$0.03555	\$0.03335	\$0.02472

Baltimore Gas & Electric Company, P (Primary Voltage Service) Electric Rate Analysis  
**Prepared by Entech Engineering, Inc.**

*Incremental Cost Check*

**\$ Calculations on Incrementals**

Demand (\$)	63,421 kW x	\$5.99 /kW =	\$379,891.79
Off-Peak Usage (\$)	23,940,642 kWh	\$0.025 /kW =	\$591,812.67
Intermediate Usage (\$)	7,228,506 kWh	\$0.033 /kW =	\$241,070.68
On-Peak Usage (\$)	9,076,532 kWh	\$0.036 /kW =	\$322,670.71
Total Calculated Billing Using Incrementals			<b>\$1,535,445.85</b>
Actual Current Period Charges			<b>\$1,524,955.85</b>
Actual Current Period Charges Minus Rider #14 Emergency Genera			<b>\$1,537,195.85</b>
Actual Current Period Charges Minus Rider #5 Air Conditioning Cr			<b>\$1,537,195.85</b>
Cost Variance (Actual Minus Incremental)			<b>\$1,750.00</b>
Percent Variance (Var/Actual)			<b>0.11%</b>

## METER READING DATES

12/22/94 TO 1/23/95

BALTIMORE GAS AND ELECTRIC COMPANY

NEXT SCHEDULED READING DATE

P.O. BOX 64844

2/22/95

BALTIMORE, MARYLAND 21264-4844

DUE

2/16/95

Bill Account

3177304016

ELECTRIC SCHEDULE P TIME OF DAY (TOD) BILL

95 JAN 31 AM 10:49

		JUN-SEPT		OCT-MAY		Days		Days		Total	
		(1)	(2)	(3)=(1)x(2)	(4)	(5)	(6)=(4)x(5)	(7)=(1)+(4)	(8)=(3)+(6)		
		UNITS	RATE	AMOUNT \$	UNITS	RATE	AMOUNT \$	KWH	NET AMT.		
A. Customer Charge Per Month											\$750.00

## B. DEMAND CHARGES

		KW		Per KW		KW		Per KW	
Production & Transmission				\$12.09		63421		\$5.99	
Distribution				\$2.33	0			\$2.33	
								\$379,891.79	
									\$379,891.79

## C. ENERGY CHARGES:

		KWH		Per KWH		KWH		Per KWH	
On-Peak				\$ 03893		9076532		\$214,206.16	\$214,206.16
Intermediate Peak				\$ 02845		7228506		\$154,690.03	\$154,690.03
Off-Peak				\$ 01571		23940642		\$305,722.00	\$305,722.00
Total Energy Charges						40245680		40245680	\$674,618.19

4-10

## RIDER CREDITS

		0	
Rider 5		\$12,240.00	
Rider 14			
Rider 15			
Rider 16			
Total Rider Credits		\$12,240.00	

## Fuel Rate- Total Energy KWH@

		0.01227	
Sub-Total		\$493,814.49	
County Surcharge		\$1,549,074.47	
Supp. Serv. Charge			
Elec. Envir. Surcharge		\$1,000.00	
Total Rider Credits		\$12,240.00	
Sub-Total		\$1,537,834.47	
State Tax			
County Tax			

## Total Electric Gross:

\$1,560,886.99 Net: \$1,537,834.47

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U S DEPT OF THE ARMY

DA-18-020-ENG-641

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Baltimore Gas & Electric Company, P (Primary Voltage Service) Electric Rate Analysis  
**Prepared by Entech Engineering, Inc.**

Billing and Client Information

Client	Fort Meade
Billing Year	1995
Billing Period	July
# of Billing Days	30
Enter "1" for Oct-May, 0 for Jun-Sept	0
Rates Schedule in Effect	Summer

Demand and Usage Information

Supply Voltage	13,200
<b><i>Demand Measurements</i></b>	
On-Peak Demand (kW)	77,335
Maximum Demand (kW)	0
<b><i>Usage Measurements</i></b>	
On-Peak Period (kWh)	14,646,852
Intermediate Period (kWh)	8,064,878
Off-Peak Period (kWh)	24,167,047
Total (kWh)	46,878,777

Taxes and Special Adjustments

Fuel Rate Total Energy Charge	\$0.01227
Electric Environment Surcharge	\$1,000.00
<b><i>Credits</i></b>	
Rider #5 Air Conditioning Credit	(\$21,040.00)
Rider #14 Emergency Generation	(\$47,220.00)

**Baltimore Gas & Electric Company, P (Primary Voltage Service) Electric Rate Analysis**  
**Prepared by Entech Engineering, Inc.**

***Duplicated Electric Bill***

Customer Charge	1 Bill @	\$750.00	Per Bill =	\$750.00
<b><i>On-Peak Usage Charge</i></b>				
Base Rate Charge	14,646,852 kWh @	\$0.03861	Per kWh =	\$565,514.96
<b><i>Intermediate Usage Charge</i></b>				
Base Rate Charge	8,064,878 kWh @	\$0.02813	Per kWh =	\$226,865.02
<b><i>Off-Peak Usage Charge</i></b>				
Base Rate Charge	24,167,047 kWh @	\$0.01539	Per kWh =	\$371,930.85
<b><i>Demand Charges</i></b>				
Maximum Demand Charge	0 kW @	\$2.33	Per kW =	\$0.00
On-Peak Demand Charge	77,335 kW @	\$12.09	Per kW =	\$934,980.15
<b><i>Other Charges and Credits</i></b>				
Fuel Rate Total Energy Charge	\$0.01227 \$/kWh x	\$46,878,777	Subtotal =	\$575,202.59
Electric Envir Surcharge		\$1,000.00	Subtotal =	\$1,000.00
Rider #5 Air Conditioning Credit		(\$21,040.00)	Subtotal =	(\$21,040.00)
Rider #14 Emergency Generation		(\$47,220.00)	Subtotal =	(\$47,220.00)
<b>CURRENT PERIOD CHARGES</b>				<b>\$2,607,983.57</b>

***Calculated Incremental***

Incremental Cost Per kW	\$12.09
Incremental Cost Per On-Peak kWh	\$0.05088
Incremental Cost Per Intermediate kWh	\$0.04040
Incremental Cost Per Off-Peak kWh	\$0.02766

***Calculated Billing Statistics Based on Incremental Costs***

Demand Cost	\$934,980.15	Energy Cost	\$1,739,513.42
% Demand	35.9%	% Energy	66.7%

***Current Electric Tariff (Rate P)***

	Summer	Winter
Customer Charge (\$/Bill)	\$750.00	\$750.00
On-Peak Demand Charge (\$/kW)	\$12.09	\$5.99
Maximum Demand Charge (\$/kW)	\$2.33	\$2.33
On-Peak Usage Charge (\$/kWh)	\$0.03861	\$0.02360
Intermediate Usage Charge (\$/kWh)	\$0.02813	\$0.02140
Off-Peak Usage Charge (\$/kWh)	\$0.01539	\$0.01277



**Baltimore Gas & Electric Company, P (Primary Voltage Service) Electric Rate Analysis**  
**Prepared by Entech Engineering, Inc.**

***Electric Bill Calculation***

Calculation Description	Actual Billing	Demand, kW Minus 1 kW	On-Peak Usage Minus 1 kWh	Intermediate Minus 1 kWh	Off-Peak Minus 1 kWh
On-Peak Demand (kW)	77,335	77,334	77,335	77,335	77,335
Maximum Demand (kW)	0	0	0	0	0
On-Peak Usage (kWh)	14,646,852	14,646,852	14,646,851	14,646,852	14,646,852
Intermediate Usage (kWh)	8,064,878	8,064,878	8,064,878	8,064,877	8,064,878
Off-Peak Usage (kWh)	24,167,047	24,167,047	24,167,047	24,167,047	24,167,046
Total Usage (kWh)	46,878,777	46,878,777	46,878,776	46,878,776	46,878,776
<i>Breakdown Calculations</i>					
Billing On-Peak Demand (kW)	77,335	77,334	77,335	77,335	77,335
Billing Maximum Demand (kW)	0	0	0	0	0
On-Peak Usage (kWh)	14,646,852	14,646,852	14,646,851	14,646,852	14,646,852
Intermediate Usage (kWh)	8,064,878	8,064,878	8,064,878	8,064,877	8,064,878
Off-Peak Usage (kWh)	24,167,047	24,167,047	24,167,047	24,167,047	24,167,046
Total Usage (kWh)	46,878,777	46,878,777	46,878,776	46,878,776	46,878,776
<i>Cost Calculation</i>					
Customer Charge, \$	\$750.00	\$750.00	\$750.00	\$750.00	\$750.00
On-Peak kWh Base Rate Charge, \$	\$565,514.96	\$565,514.96	\$565,514.92	\$565,514.96	\$565,514.96
Intermediate kWh Base Rate Charge, \$	\$226,865.02	\$226,865.02	\$226,865.02	\$226,864.99	\$226,865.02
Off-Peak kWh Base Rate Charge, \$	\$371,930.85	\$371,930.85	\$371,930.85	\$371,930.85	\$371,930.84
On-Peak Demand Charge, \$	\$934,980.15	\$934,968.06	\$934,980.15	\$934,980.15	\$934,980.15
Maximum Demand Charge, \$	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
<i>Other Charges</i>					
Fuel Rate Total Energy Charge, \$	\$575,202.59	\$575,202.59	\$575,202.58	\$575,202.58	\$575,202.58
Electric Environment Surcharge, \$	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00	\$1,000.00
<i>Discounts</i>					
Rider #5 Air Conditioning Credit	(\$21,040.00)	(\$21,040.00)	(\$21,040.00)	(\$21,040.00)	(\$21,040.00)
Rider #14 Emergency Generation	(\$47,220.00)	(\$47,220.00)	(\$47,220.00)	(\$47,220.00)	(\$47,220.00)
Net Current Bill	\$2,607,983.57	\$2,607,971.48	\$2,607,983.52	\$2,607,983.53	\$2,607,983.54
Incremental/Penalties	n/a	\$12.09	\$0.05088	\$0.04040	\$0.02766

**Baltimore Gas & Electric Company, P (Primary Voltage Service) Electric Rate Analysis**  
**Prepared by Entech Engineering, Inc.**

***Incremental Cost Check***

**\$ Calculations on Incrementals**

Demand (\$)	77,335 kW x	\$12.09 /kW =	\$934,980.15
Off-Peak Usage (\$)	24,167,047 kWh	\$0.028 /kW =	\$668,460.52
Intermediate Usage (\$)	8,064,878 kWh	\$0.040 /kW =	\$325,821.07
On-Peak Usage (\$)	14,646,852 kWh	\$0.051 /kW =	\$745,231.83
Total Calculated Billing Using Incrementals			<b>\$2,674,493.57</b>
Actual Current Period Charges			<b>\$2,607,983.57</b>
Actual Current Period Charges Minus Rider #14 Emergency Genera			<b>\$2,655,203.57</b>
Actual Current Period Charges Minus Rider #5 Air Conditioning Cr			<b>\$2,676,243.57</b>
Cost Variance (Actual Minus Incremental)			<b>\$1,750.00</b>
Percent Variance (Var/Actual)			<b>0.07%</b>

METER READING DATES  
6/22/95 TO 7/25/95  
NEXT SCHEDULED READING DATE

BALTIMORE GAS AND ELECTRIC COMPANY  
P.O. BOX 64844  
BALTIMORE, MARYLAND 21264-4844

9806 DENNIS RD  
U S DEPT OF THE ARMY  
DA-18-020-ENG-641  
AFKA-ZI-EH-PC BLDG T229  
FT MEADE MD 20755

**DUE**

8/16/95

**ELECTRIC SCHEDULE P TIME-OF-DAY (TOD) BILL**

	JUN-SEPT	33	Days	OCT-MAY	Days	Total
	(1)	(2)	(3)=(1)x(2)	(4)	(5)	(7)=(1)+(4) KWH
	UNITS	RATE	AMOUNT \$	UNITS	RATE	(8)=(3)+(6) NET AMT.
A. Customer Charge Per Month						\$ 750.00

A. Customer Charge Per Month

### 3. Demand Charges:

Production & Transmission	77335	\$ 12.09	934980.15	\$ 5.99	934980.15
Distribution	-	\$ 2.33		\$ 2.33	-

**C. ENERGY CHARGES:**

On-Peak	14646852	\$ .03861	565514.96		.02328		565514.96
Intermediate Peak	8064878	\$ .02813	226865.02		.02108		226865.02
Off-Peak	24167047	\$ .01539	371930.85		.01245		371930.85
4-15 Total Energy Charges	46878777					46878777	1164310.83

**FOR OFFICE USE ONLY**

C	C/C
CHED.	
ODE	
O. OF	
ETERS	
DATE PYMT. CHG.	
MINIMUM CHARGE:	
\$ 750.00 PLUS	
DEMAND CHARGE	

Fuel Rate Total Energy

KWH@.01227

Sub-Total

RIDER 14 CR.

RIDER 5 AIR CONDITIONING CREDIT

**County Surcharge 6000 @ 7.87**

XXXXXXXXXXXX

**Elec. Envir. Surcharge**

Sub-Total

**State Tax**

City/County Tax

**Total Electric Gross:**

\$	2647088.32	2607983.57
----	------------	------------

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## **5.0 BUILDING BY BUILDING UMCS ANALYSIS**

### **5.1 General**

The buildings analyzed in this section are as listed in Appendix B of the General Scope of Work (refer to Attachment 8.1). Each building was analyzed using either the ESA or EZDOE energy estimating programs. The format for documenting each building analysis addresses the following:

*Existing* discusses the current EMCS points in the building.

*Proposed* lists the new UMCS strategies to be applied for energy savings. Strategies will be applied with modifications explained in Section 2.6.1.

*Point List* lists the number of analog and digital points required to meet the UMCS strategies. The point lists are based on EMCS Manual TM5-815-2, dated January 1991, except as noted in the remarks column of the point list summary table for each building. Several general exceptions not noted are as follows:

- For small air handling units with outdoor air quantities of less than 500 cfm, the outdoor air damper control was deleted.
- The combustion control and monitoring points for the boiler were not applied except where the boiler selection strategy was utilized (Buildings 8481 and 2482 only).

- Fan coil proof-of-run point was not included due to the high number of fan coils in the buildings which are heated and cooled by fan coils.
- The type and amount of panels are based on the building point count. The panel abbreviations are as follows:

SFP - Smart Field Panel

RTU - Remote Terminal Unit

UC - Unitary Controller

UPS - Universal Programmable Controller

***Construction***

***Cost*** covers materials, labor, and indirect costs needed to institute the UMCS strategies, including associated engineering design and construction management costs. Costs are in 1996 dollars and are based on the new draft edition of the UMCS Cost Estimator. Refer to Attachment Sections 8.3 and 8.4.

The construction costs include building point installation costs and a percentage of the system wide UMCS costs. These costs cover the central control systems, programming, and data distribution. The cost will be distributed among the buildings based on the building point count as compared to the total system point count.

***Savings*** shows an expected level of annual cost savings and does not include price increases of various energy sources.

***Economics*** states the economic feasibility utilizing BLAST's LCCID program. LCCID calculates life cycle costs and additional economics for

energy conservation in DoD construction. Using the previous data, the economics of each building is calculated and shown in this section.

The maintenance savings are derived in two ways and are listed separately. The ESA program estimates being able to save one 4-hour man visit per year to the system being monitored. This saving is applied to individual equipment. The second savings cost is based on the current EMCS maintenance costs received from the Fort Meade Department of Public Works. The new estimated UMCS maintenance costs were then subtracted from the existing EMCS maintenance costs for a net cost savings. These costs are summarized in Section 5.2. This cost savings will only be applied to buildings currently connected to the existing EMCS. The costs are distributed based on the current point count in each building. The costs were distributed for all current buildings on the EMCS, even buildings not included in the scope. The maintenance savings associated with buildings not in this study's scope have not been included. Refer to Table 5.3 in Section 5.2 for the maintenance cost savings summary by building.

***Discussion*** notes the savings to investment ratio (SIR) and miscellaneous items of discussion.

## 5.2 Building Summary UMCS Analysis

### *Existing*

The existing base EMCS encompasses seventy-six (76) buildings for a total connected point count of 742. Of the seventy-six (76) buildings on the existing EMCS, sixty-four (64) of those buildings are within the scope of this study. These sixty-four (64) buildings include 664 of the existing 742 EMCS points.

### *Proposed*

A cost versus savings analysis was performed on sixty-four (64) buildings of the eighty-three (83) buildings in the scope. Similar buildings were grouped together as per the project scope. The ESA and DOE energy calculation programs were used to calculate each individual buildings savings. Within each Building by Building EMCS analysis is listed the UMCS strategies to be applied for energy savings in each building.

The new UMCS for Fort George G. Meade would consist of wire line Data Transmission Media (DTM) and intelligent stand alone UMCS Smart Field Panels (SFP) connected to a new Central Control Unit (CCU) located in Building 3000. The new UMCS will be considered a medium UMCS configuration as described in the EMCS Manual, TM5-815-2. The CCU would consist of a microcomputer (PC) and associated peripheral devices (printers, etc.). The PC would house specific software-controlled strategy applications and programming which would be down-loaded to the individual SFP's. The SFP would be a stand-alone

panel, meaning the programming for each building would reside in the building panel and through the LAN, the panels will exchange required information. Smaller stand alone Remote Terminal Units (RTS), Universal Programmable Controllers (UPC) and Unitary Controllers (UC) will be supported by the SFP's. The wire line DTM network would be a combination of twisted pair wires and phone lines. Fiber Optic transmission lines are not available and there are no plans by Fort Meade to install a Fiber Optic Data Communication System in the near future. Refer to the attached Figure Fig-1 for UMCS schematic.

### ***Point List***

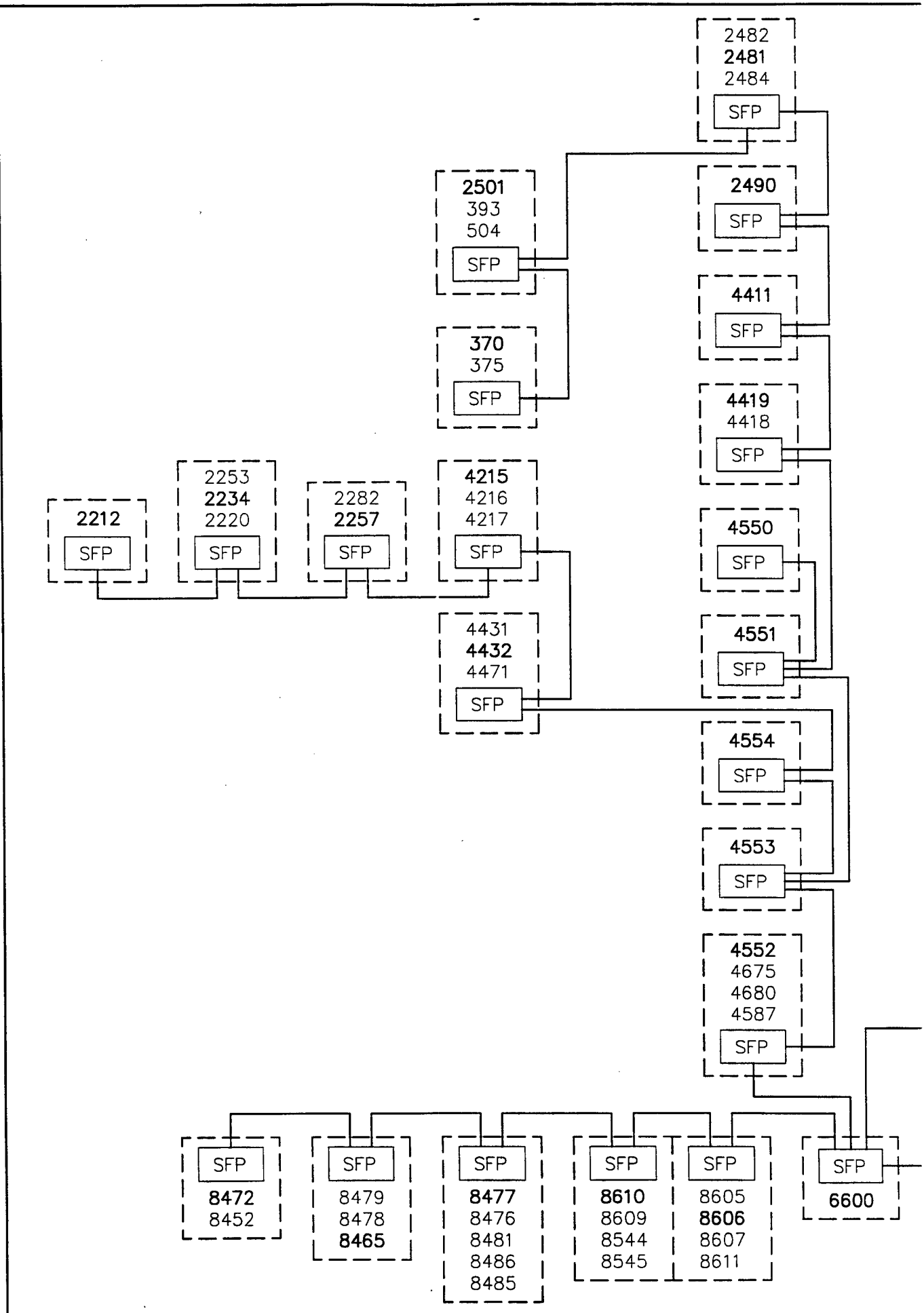
The total point count under the new UMCS for all buildings included in the scope is 2,926 points. The individual building points are broken down in each Building by Building Analysis in Section 5.3.

### ***Construction Cost***

The estimated cost to install a new UMCS at Fort Meade encompassing 64 buildings is **\$3,484,180**. Each individual building cost is summarized in Table 5.1. An additional cost breakdown can be found in Attachment Section 8.3.

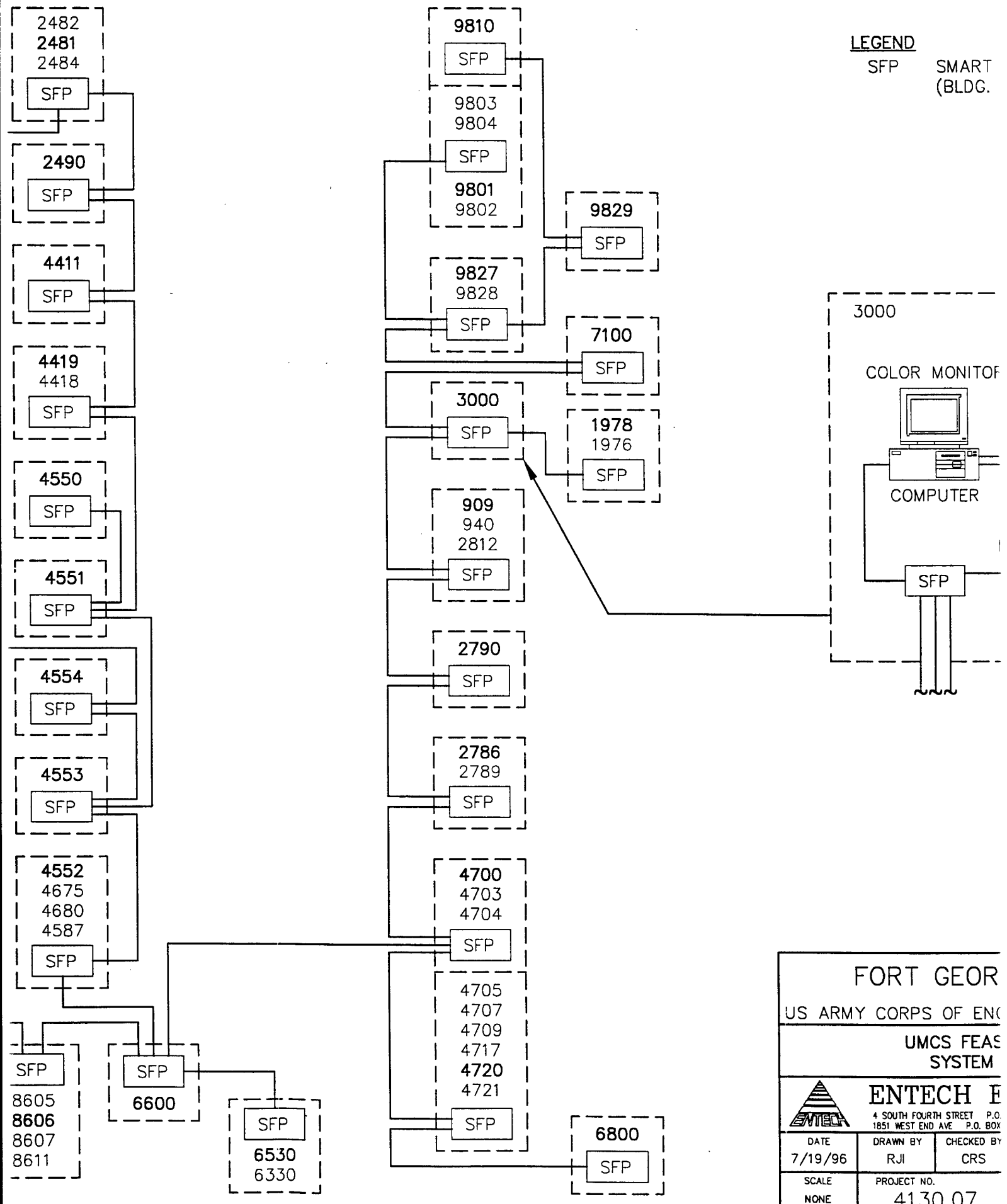
Construction	\$3,124,800
SIOH	\$ 171,900
Design	<u>\$ 187,480</u>
TOTAL	\$3,384,180





# LEGEND

SFP SMART  
(BLDG.)



FORT GEOR

US ARMY CORPS OF ENG

UMCS FEAS  
SYSTEM



ENTECH E

4 SOUTH FOURTH STREET P.O. BOX  
1851 WEST END AVE P.O. BOX

DATE  
7/19/96

DRAWN BY  
RJI

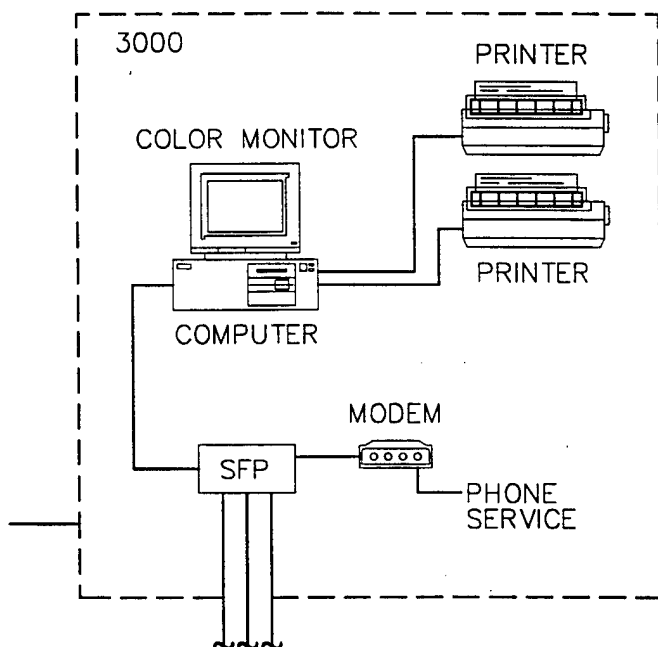
CHECKED BY  
CRS

SCALE  
NONE

PROJECT NO.  
4130.07

# LEGEND

SFP SMART FIELD PANEL  
(BLDG. WITH SFP IN BOLD)



## FORT GEORGE G. MEADE

US ARMY CORPS OF ENGINEERS BALTIMORE, MD

### UMCS FEASIBILITY STUDY SYSTEM SCHEMATIC



## ENTECH Engineering Inc.

4 SOUTH FOURTH STREET P.O. BOX 32 READING, PA 19603 (610) 373-6667  
1851 WEST END AVE P.O. BOX 389 POTTSVILLE, PA 17901 (717) 628-5655

DATE 7/19/96	DRAWN BY RJI	CHECKED BY CRS	PROJ. MGR. PAH	APPROVED DZG	
SCALE NONE	PROJECT NO. 4130.07	DRAWING NO. FIG-1	REVISION 0		

TABLE 5 - I  
COST ESTIMATE SUMMARY

Site: FORT GEORGE G. MEADE  
Date: JULY 1996  
Name: Craig Snyder - Entech Engineering  
Phone: 610-373-6667

Bldg Number	Building Point Total	Smart Field Panels & Remote Terminal Units Costs			Unitary Controllers & Universal Programmable			Total Building Costs	20.0% Overhead & Profit	Sub-Total	1.25% Contractor Bond	Sub-Total	1.3% escalation	Sub-Total	3.5% Contngncy	System wide Cost / Bldg	Sub-Total	5.5% SIOH	6.0% Design	Total
		DDC Cost	Super Cost	Total Cost	DDC Cost	Super Cost	Total Cost													
370	43	\$22,210	\$0	\$22,210	\$0	\$0	\$0	\$22,210	\$4,440	\$26,650	\$280	\$26,930	\$330	\$26,980	\$940	\$4,530	\$32,450	\$1,780	\$1,950	\$36,180
375	9	\$0	\$0	\$0	\$0	\$5,580	\$5,580	\$5,580	\$1,120	\$6,700	\$70	\$6,770	\$80	\$6,780	\$240	\$950	\$7,970	\$440	\$480	\$8,890
393	12	\$0	\$0	\$0	\$0	\$3,730	\$3,730	\$3,730	\$750	\$4,480	\$50	\$4,530	\$60	\$4,540	\$160	\$1,260	\$5,960	\$330	\$360	\$6,650
504	5	\$0	\$0	\$0	\$0	\$3,210	\$3,210	\$3,210	\$640	\$3,850	\$40	\$3,890	\$50	\$3,900	\$140	\$530	\$4,570	\$250	\$270	\$5,090
909	63	\$28,450	\$8,980	\$37,430	\$0	\$0	\$0	\$37,430	\$7,490	\$44,920	\$470	\$45,390	\$560	\$45,480	\$1,590	\$6,630	\$53,700	\$2,950	\$3,220	\$59,870
940	16	\$0	\$0	\$0	\$0	\$5,220	\$5,220	\$5,220	\$1,040	\$6,260	\$70	\$6,330	\$80	\$6,340	\$220	\$1,680	\$8,240	\$450	\$490	\$9,180
1978	58	\$11,780	\$37,500	\$49,280	\$0	\$0	\$0	\$49,280	\$9,860	\$59,140	\$620	\$59,760	\$740	\$59,880	\$2,100	\$6,100	\$68,080	\$3,740	\$4,080	\$75,900
2212	40	\$0	\$17,980	\$17,980	\$0	\$0	\$0	\$17,980	\$3,600	\$21,580	\$220	\$21,800	\$270	\$21,850	\$760	\$4,210	\$26,820	\$1,480	\$1,610	\$29,910
2220	26	\$2,500	\$10,300	\$12,800	\$0	\$0	\$0	\$12,800	\$2,560	\$15,360	\$160	\$15,520	\$190	\$15,550	\$540	\$2,740	\$18,830	\$1,040	\$1,130	\$21,000
2234	34	\$0	\$33,700	\$33,700	\$0	\$0	\$0	\$33,700	\$6,740	\$40,440	\$420	\$40,860	\$510	\$40,950	\$1,430	\$3,580	\$45,960	\$2,530	\$2,760	\$51,250
2251	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
2253	6	\$0	\$0	\$0	\$0	\$2,770	\$2,770	\$2,770	\$550	\$3,320	\$30	\$3,350	\$40	\$3,360	\$120	\$630	\$4,110	\$230	\$250	\$4,590
2257	62	\$0	\$58,000	\$58,000	\$0	\$0	\$0	\$58,000	\$11,600	\$69,600	\$730	\$70,330	\$870	\$70,470	\$2,470	\$6,530	\$79,470	\$4,370	\$4,770	\$88,610
2282	39	\$0	\$35,040	\$35,040	\$0	\$0	\$0	\$35,040	\$7,010	\$42,050	\$440	\$42,490	\$530	\$42,580	\$1,490	\$4,100	\$48,170	\$2,650	\$2,890	\$53,710
2481	22	\$9,280	\$2,130	\$11,410	\$0	\$0	\$0	\$11,410	\$2,280	\$13,690	\$140	\$13,830	\$170	\$13,860	\$490	\$2,320	\$16,670	\$920	\$1,000	\$18,590
2482	39	\$0	\$207,400	\$207,400	\$0	\$0	\$0	\$207,400	\$41,480	\$248,880	\$2,590	\$251,470	\$3,110	\$251,990	\$8,820	\$4,100	\$264,910	\$14,570	\$15,890	\$295,370
2484	21	\$0	\$0	\$0	\$8,540	\$5,120	\$13,660	\$13,660	\$2,730	\$16,390	\$170	\$16,560	\$200	\$16,590	\$580	\$2,210	\$19,380	\$1,070	\$1,160	\$21,610
2490	45	\$0	\$37,920	\$37,920	\$0	\$0	\$0	\$37,920	\$7,580	\$45,500	\$470	\$45,970	\$570	\$46,070	\$1,610	\$4,740	\$52,420	\$2,880	\$3,150	\$58,450
2501	55	\$0	\$20,960	\$20,960	\$0	\$0	\$0	\$20,960	\$4,190	\$25,150	\$260	\$25,410	\$310	\$25,460	\$890	\$5,790	\$32,140	\$1,770	\$1,930	\$35,840
2786	42	\$10,330	\$20,460	\$30,790	\$0	\$0	\$0	\$30,790	\$6,160	\$36,950	\$380	\$37,330	\$460	\$37,410	\$1,310	\$4,420	\$43,140	\$2,370	\$2,590	\$48,100
2789	40	\$11,910	\$19,940	\$31,850	\$0	\$0	\$0	\$31,850	\$6,370	\$38,220	\$400	\$38,620	\$480	\$38,700	\$1,350	\$4,210	\$44,260	\$2,430	\$2,660	\$49,350
2790	100	\$28,060	\$0	\$28,060	\$0	\$0	\$0	\$28,060	\$5,610	\$33,670	\$350	\$34,020	\$420	\$34,090	\$1,190	\$10,530	\$45,810	\$2,520	\$2,750	\$51,080
2793	0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
2812	12	\$0	\$11,140	\$11,140	\$0	\$0	\$0	\$11,140	\$2,230	\$13,370	\$140	\$13,510	\$170	\$13,540	\$470	\$1,260	\$15,270	\$840	\$920	\$17,030
3000	12	\$6,990	\$920	\$7,910	\$0	\$0	\$0	\$7,910	\$1,580	\$9,490	\$100	\$9,590	\$120	\$9,610	\$340	\$1,260	\$11,210	\$620	\$670	\$12,500
4215	42	\$0	\$42,980	\$42,980	\$0	\$0	\$0	\$42,980	\$8,600	\$51,580	\$540	\$52,120	\$640	\$52,220	\$1,830	\$4,420	\$58,470	\$3,220	\$3,510	\$65,200
4216	35	\$0	\$34,610	\$34,610	\$0	\$0	\$0	\$34,610	\$6,920	\$41,530	\$430	\$41,960	\$520	\$42,050	\$1,470	\$3,680	\$47,200	\$2,600	\$2,830	\$52,630
4217	42	\$0	\$39,400	\$39,400	\$0	\$0	\$0	\$39,400	\$7,880	\$47,280	\$490	\$47,770	\$590	\$47,870	\$1,680	\$4,420	\$53,970	\$2,970	\$3,240	\$60,180
4411	86	\$25,130	\$32,270	\$57,400	\$0	\$0	\$0	\$57,400	\$11,480	\$68,880	\$720	\$69,600	\$860	\$69,740	\$2,440	\$9,050	\$81,230	\$4,470	\$4,870	\$90,570
4418	27	\$0	\$0	\$0	\$4,610	\$19,110	\$23,720	\$23,720	\$4,740	\$28,460	\$300	\$28,760	\$360	\$28,820	\$1,010	\$2,840	\$32,670	\$1,800	\$1,960	\$36,430
4419	67	\$0	\$28,600	\$28,600	\$0	\$0	\$0	\$28,600	\$5,720	\$34,320	\$360	\$34,680	\$430	\$34,750	\$1,220	\$7,050	\$43,020	\$2,370	\$2,580	\$47,970
4431	18	\$7,110	\$8,930	\$16,040	\$0	\$0	\$0	\$16,040	\$3,210	\$19,250	\$200	\$19,450	\$240	\$19,490	\$680	\$1,890	\$22,060	\$1,210	\$1,320	\$24,590
4432	55	\$0	\$40,610	\$40,610	\$0	\$0	\$0	\$40,610	\$8,120	\$48,730	\$510	\$49,240	\$610	\$49,340	\$1,730	\$5,790	\$56,860	\$3,130	\$3,410	\$63,400
4471	9	\$0	\$0	\$0	\$0	\$2,700	\$2,700	\$2,700	\$540	\$3,240	\$30	\$3,270	\$40	\$3,280	\$110	\$950	\$4,340	\$240	\$260	\$4,840
4550	151	\$6,450	\$100,450	\$106,900	\$0	\$0	\$0	\$106,900	\$21,380	\$128,280	\$1,340	\$129,620	\$1,600	\$129,880	\$4,550	\$15,890	\$150,320	\$8,270	\$9,020	\$167,610
4551	75	\$0	\$46,300	\$46,300	\$0	\$0	\$0	\$46,300	\$9,260	\$55,560	\$580	\$56,140	\$690	\$56,250	\$1,970	\$7,890	\$66,110	\$3,640	\$3,970	\$73,720
4552	91	\$17,420	\$26,990	\$44,410	\$0	\$0	\$0	\$44,410	\$8,880	\$53,290	\$560	\$53,850	\$670	\$53,960	\$1,890	\$9,580	\$66,430	\$3,600	\$3,930	\$72,960
4553	137	\$17,420	\$65,050	\$82,470	\$0	\$0	\$0	\$82,470	\$16,490	\$98,960	\$1,030	\$99,990	\$1,240	\$100,200	\$3,510	\$14,420	\$118,130	\$6,500	\$7,090	\$131,720
4554	154	\$7,830	\$73,060	\$80,890	\$0	\$0	\$0	\$80,890	\$16,180	\$97,070	\$1,010	\$98,080	\$1,210	\$98,280	\$3,440	\$16,210	\$117,930	\$6,490	\$7,080	\$131,590
4587	20	\$0	\$0	\$0	\$4,250	\$2,820	\$7,070	\$7,070	\$1,410	\$8,480	\$90	\$8,570	\$110	\$8,590	\$300	\$2,110	\$11,000	\$610	\$660	\$12,270
4675	8	\$0	\$0	\$0	\$3,870	\$0	\$3,870	\$3,870	\$770	\$4,640	\$50	\$4,690	\$60	\$4,700	\$160	\$840	\$5,700	\$310	\$340	\$6,350
4680	16	\$0	\$0	\$0	\$4,610	\$15,810	\$20,420	\$20,420	\$4,080	\$24,500	\$260	\$24,760	\$310	\$24,810	\$870	\$1,680	\$27,260	\$1,500	\$1,640	\$30,500
4700	50	\$4,790	\$21,820	\$26,610	\$0	\$0	\$0	\$26,610	\$5,320	\$31,930	\$330	\$32,260	\$400	\$32,330	\$1,130	\$5,560	\$38,720	\$2,130	\$2,320	\$43,170
4703	72	\$0	\$27,340	\$27,340	\$0	\$33,600	\$33,600	\$60,940	\$12,190	\$73,130	\$760	\$73,890	\$910	\$74,040	\$2,590	\$7,580	\$84,210	\$4,630	\$5,050	\$93,890
4705	72	\$0	\$0	\$0	\$52,440	\$52,440	\$52,440	\$10,490	\$62,930	\$660	\$63,590	\$790	\$63,720	\$2,230	\$7,580	\$73,530	\$4,040	\$4,410	\$81,980	
6330	28	\$7,310	\$16,510	\$23,820	\$0	\$0	\$0	\$23,820	\$4,760	\$28,580	\$300	\$28,880	\$360	\$28,940	\$1,010	\$2,950	\$32,900	\$1,810	\$1,970	\$36,680
6530	61	\$10,330	\$27,820	\$38,150	\$0	\$0	\$0	\$38,150	\$7,630	\$45,780	\$480	\$46,260	\$570	\$46,350	\$1,620	\$6,420	\$54,390	\$2,990	\$3,260	\$60,640
6600	127	\$43,260	\$26,760	\$70,020	\$0	\$0	\$0	\$70,020	\$14,000	\$84,020	\$880	\$84,900	\$1,050	\$85,070	\$2,980	\$13,370	\$101,420	\$5,580	\$6,090	\$113,090
6800	20	\$7,580	\$0	\$7,580	\$0	\$0	\$0	\$7,580	\$1,520	\$9,100	\$90	\$9,190	\$110	\$9,210	\$320	\$2,110	\$11,640	\$640	\$700	\$12,980
7100	27	\$0	\$24,370	\$24,370	\$0	\$0	\$0	\$24,370	\$4,870	\$29,240	\$300	\$29,540	\$370	\$29,610	\$1,040	\$2,840	\$33,490	\$1,840	\$2,010	\$37,340
8452	65	\$30,050	\$7,450	\$37,500	\$0	\$0	\$0	\$37,500	\$7,500	\$45,000	\$470	\$45,470	\$560	\$45,560	\$1,590	\$6,840	\$53,990	\$2,970	\$3,240	\$60,200
8465	36	\$6,240																		

### *Savings*

The total anticipated savings from all buildings is \$500,830, plus \$81,670 in EMCS maintenance savings for a total savings of **\$582,500**. These figures are summarized in Table 5.2, Building Summary and Table 5.3, Maintenance Cost Savings Summary. The individual building energy source savings are summarized in each Building by Building Analysis in Section 5.3.

### *Economics*

Using the LCCID Program, the economics for the project were calculated with all buildings included. The LCCID output is as follows: (reference to attached LCCID output).

#### LCCID Inputs

Electric Energy Saved	=	19,695.8 mmBtu (5,770,813 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
Oil Energy Saved	=	7,601.6 mmBtu (54,806 gallons x 138,700 Btu/gal ÷ 1,000,000 Btu/mmBtu)
Gas Energy Saved	=	61,877.7 mmBtu (60,017.2 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
Electric Demand Saved	=	122.4 kW
Construction \$	=	\$3,124,800
SIOH \$	=	\$171,900

Design \$ = \$187,480

Maintenance \$ = \$32,130 & \$81,670

Saving to Investment Ratio (SIR)	<b>1.47</b>
Simple Payback (Years)	<b>5.97</b>

### ***Discussion***

Refer to Table 5.4 for a systems summary of each buildings economic analysis. The SIR with all buildings included is greater than 1.25. This SIR included many buildings with an individual SIR of less than 1.25. Section 6.0 will summarize the recommended Base UMCS ECO with only buildings that have a 1.25 SIR or better

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING SAVINGS SUMMARY  
TABLE 5-2**

INCREMENTAL COSTS:		Gallon of Oil:			
KWH:	\$0.032	MCF:			
KW:	\$96.28	Labor per Hour			
Building	Electric Usage Savings		Electric Demand Savings		#2 Fuel Oil Savings
	KWH	\$	KW	\$	
370	7,348	\$240	2.4	\$230	0
375	7,486	\$240	0.0	\$0	0
383	59,097	\$1,890	0.7	\$70	0
504	52,416	\$1,680	0.0	\$0	0
909	105,160	\$3,370	3.1	\$300	0
940	5,519	\$180	0.3	\$30	3,387
1978	209,099	\$6,690	6.0	\$580	0
1976					
2212	51,531	\$1,650	0.0	\$0	0
2220	58,440	\$1,870	0.0	\$0	2,089
2234	134,934	\$4,320	0.0	\$0	0
2251	0	\$0	0.0	\$0	0
2253	34,944	\$1,120	0.0	\$0	0
2257	156,867	\$5,020	0.0	\$0	0
2282	56,274	\$1,800	0.0	\$0	0
2481	61,683	\$1,970	4.5	\$430	3,662
2482	0	\$0	0.0	\$0	4,010
2484	62,672	\$2,010	0.0	\$0	2,529
2490	67,035	\$2,150	0.0	\$0	34,373
2501	41,715	\$1,330	0.4	\$40	0
2786	184,264	\$5,900	0.0	\$0	0
2789	72,938	\$2,330	0.3	\$30	0
2790	171,790	\$5,500	0.0	\$0	0
2793	0	\$0	0.0	\$0	0
2812	11,526	\$370	0.0	\$0	0
3000	5,732	\$180	1.5	\$140	0
4215	176,168	\$5,640	0.0	\$0	0
4216	82,171	\$2,630	0.0	\$0	0
4217	78,263	\$2,500	0.0	\$0	0
4411	476,660	\$15,250	3.4	\$330	0
4418	7,799	\$250	0.0	\$0	304
4419	45,824	\$1,470	2.7	\$260	0
4431	18,751	\$600	0.7	\$70	0
4432	85,911	\$2,750	2.0	\$190	0
4471	8,580	\$270	1.5	\$140	419
4550	473,710	\$15,150	19.8	\$1,910	0
4551	43,965	\$1,410	0.8	\$80	0
4552	396,545	\$12,690	7.5	\$720	0
4553	688,592	\$22,030	14.9	\$1,430	0
4554	837,692	\$26,810	16.0	\$1,540	0
4587	2,267	\$70	0.0	\$0	1,792
4675	14,335	\$460	0.3	\$30	0
Natural Gas Savings		Labor Savings		Total	
MCF		Hours		\$	
352.2	\$1,400	20	\$550	\$2,420	388
79.1	\$310	8	\$220	\$770	107
321.2	\$1,270	8	\$220	\$3,450	533
197.1	\$780	8	\$220	\$2,680	382
413.4	\$1,640	20	\$550	\$5,860	785
0.0	\$0	8	\$220	\$2,530	489
860.6	\$3,420	28	\$770	\$11,460	1,601
0.0	\$0	12	\$330	\$1,980	176
0.0	\$0	12	\$330	\$3,500	489
328.0	\$1,300	12	\$330	\$5,350	799
0.0	\$0	0	\$0	\$0	0
179.7	\$710	4	\$110	\$1,940	305
1,458.1	\$5,790	16	\$440	\$11,250	2,039
153.3	\$610	12	\$330	\$2,740	350
0.0	\$0	12	\$330	\$5,000	718
0.0	\$0	12	\$330	\$2,820	555
0.0	\$0	12	\$330	\$3,910	565
0.0	\$0	20	\$550	\$24,010	4,996
56.9	\$230	24	\$660	\$2,260	201
1,093.6	\$4,340	16	\$440	\$10,680	1,756
125.3	\$500	16	\$440	\$3,300	378
3,373.9	\$13,390	100	\$2,750	\$21,540	4,065
0.0	\$0	0	\$0	\$0	0
56.8	\$230	8	\$220	\$820	98
482.6	\$1,840	8	\$220	\$2,380	497
1,525.4	\$6,060	12	\$330	\$12,030	2,174
574.2	\$2,280	12	\$330	\$5,240	872
613.6	\$2,440	8	\$220	\$5,160	900
2,373.6	\$9,420	28	\$770	\$25,770	4,074
0.0	\$0	8	\$220	\$660	69
514.5	\$2,040	24	\$660	\$4,430	687
170.7	\$680	8	\$220	\$1,570	240
827.0	\$3,280	20	\$550	\$6,770	1,146
0.0	\$0	8	\$220	\$890	87
7,134.9	\$28,330	40	\$1,100	\$46,500	8,973
693.9	\$2,750	28	\$770	\$5,010	865
1,737.6	\$6,900	32	\$880	\$21,190	3,145
5,881.5	\$23,350	36	\$990	\$47,800	8,414
7,039.4	\$27,950	44	\$1,210	\$57,510	10,117
0.0	\$0	8	\$220	\$1,400	256
0.0	\$0	4	\$110	\$600	49

4550	473,710	\$15,160	19.8	\$1,910	0	\$0	7,134.9	\$28,330	40	\$1,100	\$46,500	8,973
4551	43,965	\$1,410	0.8	\$80	0	\$0	693.9	\$2,750	28	\$770	\$5,010	865
4552	396,545	\$12,690	7.5	\$720	0	\$0	1,737.6	\$6,900	32	\$880	\$21,190	3,145
4553	688,592	\$22,030	14.9	\$1,430	0	\$0	5,881.5	\$23,350	36	\$990	\$47,800	8,414
4554	837,692	\$26,810	16.0	\$1,540	0	\$0	7,039.4	\$27,950	44	\$1,210	\$57,510	10,117
4587	2,267	\$70	0.0	\$0	1,792	\$1,110	0.0	\$0	8	\$220	\$1,400	256
4675	14,335	\$460	0.3	\$30	0	\$0	0.0	\$0	4	\$110	\$600	49
4680	200	\$10	0.0	\$0	601	\$370	0.0	\$0	8	\$220	\$600	84
4700	6,177	\$200	0.7	\$70	0	\$0	1,099.1	\$4,360	24	\$660	\$5,290	1,154
4703	5,430	\$170	0.0	\$0	0	\$0	456.0	\$1,810	24	\$660	\$2,640	489
4704												
4717												
4720												
4721												
4705	6,516	\$210	0.0	\$0	0	\$0	377.1	\$1,500	24	\$10	\$1,720	411
4707												
4709												
6330	137,952	\$4,410	0.0	\$0	0	\$0	3,922.5	\$15,570	16	\$440	\$20,420	4,515
6530	43,572	\$1,390	0.9	\$90	0	\$0	1,752.9	\$6,960	20	\$550	\$8,990	1,956
6600	221,231	\$7,080	4.3	\$410	0	\$0	1,314.4	\$5,220	44	\$1,210	\$13,920	2,110
6800	275	\$10	3.0	\$290	0	\$0	141.8	\$560	20	\$550	\$1,410	147
7100	29,344	\$940	0.0	\$0	0	\$0	733.6	\$2,910	12	\$330	\$4,180	856
8452	59,282	\$1,900	2.4	\$230	0	\$0	1,282.6	\$5,090	20	\$550	\$7,770	1,525
8465	8,577	\$270	0.4	\$40	0	\$0	324.8	\$1,290	12	\$330	\$1,930	364
8472	11,118	\$360	0.0	\$0	0	\$0	369.9	\$1,470	12	\$330	\$2,160	419
8476	18,884	\$600	0.0	\$0	0	\$0	44.4	\$180	8	\$220	\$1,000	110
8477	18,884	\$600	0.0	\$0	0	\$0	44.4	\$180	8	\$220	\$1,000	110
8478	26,478	\$850	0.0	\$0	0	\$0	4,248.0	\$16,860	108	\$2,970	\$20,680	4,470
8479												
8544												
8545												
8605												
8607												
8609												
8610												
8611												
8481	0	\$0	0.0	\$0	0	\$0	708.0	\$2,810	12	\$330	\$3,140	730
8485	0	\$0	0.0	\$0	1,640	\$1,020	0	\$0	8	\$0	\$1,020	227
8486												
8606	2,942	\$90	0.0	\$0	0	\$0	473.3	\$1,880	12	\$330	\$2,300	498
9801	28,396	\$910	20.0	\$1,930	0	\$0	8	\$30	32	\$880	\$3,750	106
9802												
9803												
9804												
9810	28,510	\$910	1.9	\$180	0	\$0	1,511.4	\$6,000	28	\$770	\$7,860	1,656
9827	4,176	\$130	0.0	\$0	0	\$0	363.7	\$1,440	8	\$220	\$1,790	389
9828	32,012	\$1,020	0.0	\$0	0	\$0	609.7	\$2,420	8	\$220	\$3,660	738
9829	25,154	\$800	0.0	\$0	0	\$0	1,633.1	\$6,480	16	\$440	\$7,720	1,770
TOTALS	5,770,813	\$184,660	122.4	\$11,790	54,806	\$33,990	60,017.2	\$238,260	1,200	\$32,130	\$500,830	89,175
Total mmBTU	19,695.8				7,601.6		61,877.7					89,175



**TABLE 5 - 3  
MAINTENANCE COST SAVINGS SUMMARY**

Existing Maintenance Costs		UMCS Maintenance Costs	
Annual Honeywell Service Contract	\$12,000	10% of System Wide Co	\$31,000
In-House Expenses:			
Repair of EMCS	\$8,300	1% of Total Bldg Cost	\$29,000
Service Orders EMCS Related	\$71,700		
20% HVAC Service Orders EMCS Related	\$59,300		
Bldgs not included in study	(\$9,690)		
<b>Total</b>	<b>\$141,610</b>		<b>\$60,000</b>

BLDG	EXIST POINT COUNT	CURRENT MAINTENANCE COST	NEW UMCS MAINTENANCE COST	MAINTENANCE COST SAVINGS
80	5	\$620		
84	3	\$370		
85	11	\$1,370		
90	4	\$500		
370	20	\$4,280	\$1,820	\$2,460
504	6	\$1,270	\$540	\$730
940	6	\$1,270	\$540	\$730
2212	6	\$1,270	\$540	\$730
2220	7	\$1,490	\$630	\$860
2234	8	\$1,700	\$720	\$980
2246	3	\$370		
2253	3	\$640	\$270	\$370
2257	8	\$1,700	\$720	\$980
2481	9	\$1,920	\$810	\$1,110
2501	3	\$640	\$270	\$370
2789	11	\$2,340	\$990	\$1,350
2790	42	\$8,970	\$3,810	\$5,160
2812	2	\$430	\$180	\$250
4215	10	\$2,130	\$900	\$1,230
4216	6	\$1,270	\$540	\$730
4217	5	\$1,070	\$450	\$620
4408	4	\$500		
4411	10	\$2,130	\$900	\$1,230
4418	7	\$1,490	\$630	\$860
4419	8	\$1,700	\$720	\$980
4431	8	\$1,700	\$720	\$980
4432	14	\$3,000	\$1,280	\$1,720
4463	3	\$370		
4471	8	\$1,700	\$720	\$980
6600	4	\$860	\$360	\$500
4550	44	\$9,390	\$3,980	\$5,410
4551	9	\$1,920	\$810	\$1,110
4552	36	\$7,690	\$3,260	\$4,430
4553	56	\$11,970	\$5,070	\$6,900
4554	42	\$8,970	\$3,810	\$5,160
4680	4	\$860	\$360	\$500
4700	33	\$7,040	\$2,980	\$4,060
4703	3	\$640	\$270	\$370
4704	3	\$640	\$270	\$370
4705	3	\$640	\$270	\$370
4707	3	\$640	\$270	\$370
4709	3	\$640	\$270	\$370
4720	8	\$1,700	\$720	\$980
6330	13	\$2,780	\$1,180	\$1,600
6530	14	\$3,000	\$1,280	\$1,720
7100	7	\$1,490	\$630	\$860
8451	13	\$1,620		
8452	23	\$4,910	\$2,080	\$2,830
8465	7	\$1,490	\$630	\$860
8472	8	\$1,700	\$720	\$980
8476	4	\$860	\$360	\$500
8478	11	\$2,340	\$990	\$1,350
8479	4	\$860	\$360	\$500
8487	3	\$370		
8501	4	\$500		
8503	6	\$750		
8543	4	\$500		
8544	5	\$1,070	\$450	\$620
8545	11	\$2,340	\$990	\$1,350
8605	11	\$2,340	\$990	\$1,350
8606	11	\$2,340	\$990	\$1,350
8607	5	\$1,070	\$450	\$620
8609	5	\$1,070	\$450	\$620
8610	11	\$2,340	\$990	\$1,350
8611	4	\$860	\$360	\$500
9801	9	\$1,920	\$810	\$1,110
9802	7	\$1,490	\$630	\$860
9803	9	\$1,920	\$810	\$1,110
9804	7	\$1,490	\$630	\$860
9810	18	\$3,850	\$1,640	\$2,210
9827	4	\$500		
9828	11	\$1,370		
9829	2	\$430	\$180	\$250
	742	\$151,380	\$60,000	\$81,670

**TABLE 5 - 4**  
**UMCS FEASIBILITY STUDY**  
**FORT MEADE**  
**DISTRIBUTED-PROCESS MONITOR AND CONTROL SYSTEMS (UMCS)**  
**SYSTEMS SUMMARY ECONOMICS ANALYSIS**

Building	Number of Points	Savings			First Costs				Investment	
		mmBtu	Dollar \$	EMCS Maintenance \$	Construction Cost \$	SIOH \$	Design Cost \$	Building Total \$	SIR	Simple Payback (years)
370	43	388	\$2,400	\$2,460	\$32,450	\$1,780	\$1,950	\$36,180	1.14	7.42
375	9	107	\$800		\$7,970	\$440	\$480	\$8,890	0.76	11.49
393	12	533	\$3,500		\$5,960	\$330	\$360	\$6,650	4.51	1.92
504	5	382	\$2,700	\$730	\$4,570	\$250	\$270	\$5,090	5.67	1.49
909	63	785	\$5,900		\$53,700	\$2,950	\$3,220	\$59,870	0.84	10.21
940	16	489	\$2,500	\$730	\$8,240	\$450	\$490	\$9,180	3.24	2.81
1978	58	1,601	\$11,500		\$68,080	\$3,740	\$4,080	\$75,900	1.29	6.61
1976										
2212	40	176	\$2,000	\$730	\$26,820	\$1,480	\$1,610	\$29,910	0.74	11.02
2220	26	489	\$3,500	\$860	\$18,830	\$1,040	\$1,130	\$21,000	1.79	4.81
2234	34	799	\$6,000	\$980	\$45,960	\$2,530	\$2,760	\$51,250	1.14	7.38
2251		0	\$0							
2253	6	305	\$1,900	\$370	\$4,110	\$230	\$250	\$4,590	4.32	1.98
2257	62	2,039	\$11,300	\$980	\$79,470	\$4,370	\$4,770	\$88,610	1.21	7.24
2282	39	350	\$2,700		\$48,170	\$2,650	\$2,890	\$53,710	0.43	19.57
2481	22	718	\$5,000	\$1,110	\$16,670	\$920	\$1,000	\$18,590	2.87	3.03
2482	39	556	\$2,800		\$264,910	\$14,570	\$15,890	\$295,370	0.09	104.26
2484	21	565	\$3,900		\$19,380	\$1,070	\$1,160	\$21,610	1.59	5.51
2490	45	4,996	\$24,000		\$52,420	\$2,880	\$3,150	\$58,450	3.92	2.42
2501	55	201	\$2,300	\$370	\$32,140	\$1,770	\$1,930	\$35,840	0.61	13.54
2786	42	1,756	\$10,700		\$43,140	\$2,370	\$2,590	\$48,100	1.94	4.50
2789	40	378	\$3,300	\$1,350	\$44,260	\$2,430	\$2,660	\$49,350	0.78	10.60
2790	100	4,065	\$21,600	\$5,160	\$45,810	\$2,520	\$2,750	\$51,080	4.63	1.91
2793		0	\$0							



8478	201	4,410	\$20,100	\$0,200	\$444,200	\$12,200	\$10,000	\$246,720		
8479										
8544										
8545										
8605										
8607										
8609										
8610										
8611										
8481	33	730	\$3,100		\$221,270	\$12,170	\$13,280	\$246,720	0.12	78.47
8485	8	227	\$1,000		\$3,380	\$190	\$200	\$3,770	19.34	0.50
8486										
8606	23	498	\$2,300	\$1,350	\$25,580	\$1,410	\$1,530	\$28,520	1.13	7.81
9801	76	106	\$3,800	\$3,940	\$91,480	\$5,030	\$5,490	\$102,000	0.61	13.26
9802										
9803										
9804										
9810	65	1,656	\$7,900	\$2,210	\$53,240	\$2,930	\$3,190	\$59,360	1.72	5.13
9827	25	389	\$1,800		\$5,910	\$330	\$350	\$6,590	2.52	3.66
9828	25	738	\$3,700		\$5,280	\$290	\$320	\$5,890	5.63	1.61
9829	18	1,770	\$7,700	\$250	\$10,370	\$570	\$620	\$11,560	6.39	1.45
TOTALS	2,926	89,175	\$501,100	\$81,670	\$3,124,800	\$171,900	\$187,480	\$3,484,180	1.47	5.97

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE4

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: ALLTOTAL

ANALYSIS DATE: 07-25-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	3124800.	
B. SIOH	\$	171900.	
C. DESIGN COST	\$	187480.	
D. TOTAL COST (1A+1B+1C)	\$	3484180.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			\$ 3484180.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	19696.	\$ 185141.	8.18	\$ 1514450.
B. DIST	\$ 4.50	7602.	\$ 34207.	9.64	\$ 329757.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	61868.	\$ 238193.	9.51	\$ 2265211.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 11790.	8.07	\$ 95145.
N. TOTAL		89166.	\$ 469330.		\$ 4204564.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$ 113800.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 918366.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 918366.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 583130.

5. SIMPLE PAYBACK PERIOD (1G/4) 5.97 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 5122930.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  1.47  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 8.19 %

### 5.3 Building by Building Analysis

The following buildings were surveyed and an individual building analysis was performed for each:

370	NCO Dining	4471	Credit Union
375	Mail Room and Warehouse	4550	Administrative
393	Administration	4551	Administrative
504	Training Arts Center	4552	Administrative
909	Youth Center	4553	Administrative
940	Morale Support Office	4554	Administrative
1978 & 1976	Administrative & Warehouse	4587	Exchange Service Outlet
2212	Administrative	4675	Exchange Service Outlet
2220	Repair Shop and Office	4680	Exchange Service Outlet
2234	Administrative	4700	Band Training Facility
2251	Boiler Plant	4703, 4704, 4717, 4720, & 4721	Officers Quarters
2253	Vehicle Maintenance Shop	4705, 4707, & 4709	Officers Quarters
2257	Administrative	6330	Physical Fitness Center
2282	Administrative R&D	6530	Skill Development Center
2481	UEPH	6600	Officers Club
2482	Boiler Plant	6800	Club House
2484	Medical Warehouse	7100	Chapel Center Facility
2490	Laboratory	8452	Recreation Center
2501	Administrative	8465	Post Chapel
2786	Commissary	8472	Dental Clinic
2789	Post Office	8476	Battalion Headquarters Bldg.
2790	Post Exchange	8477	Battalion Headquarters Bldg.
2793	Guest Housing	8478, 8479, 8544, 8545, 8605, 8607, 8609, 8610, & 8611	UEPH
2812	Administrative	8484	Boiler Plant
3000	FE Facility	8485 & 8486	Org. Vehicle Maint. Shop
4215	Administrative	8606	UEPH
4216	Administrative	9801, 9802, 9803, & 9804	UEPH
4217	Administrative	9810	Recreation Center
4411	Administrative	9827	UEPH
4418	Post Library	9828	UEPH
4419	Post Chapel	9829	Enlisted Personnel Dining
4431	Theater		
4432	Administrative		

## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 370 - NCO DINING

**Existing.** In Building 370, there are ten (10) points currently connected to the existing EMCS, six (6) temperature monitoring (space temperature, five (5) air temperatures and steam supply temperature), four (4) start/stop points (2 AHUs and condensing units). These points are monitoring only points. Four AHU's heat and cool the building, each with a steam coil and a DX coil. An air cooled DX chiller with four circuits and gas fired steam boiler provide the cooling and heating.

**Proposed.** Building 370 is heated and cooled by air handling units. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2A for building envelope and equipment. Table 370-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	4	2	4	3	13		
AHU-2	4	2	2	2	10		
AHU-3	4	2	2	2	10		
AHU-4	4	2	2	2	10		
						SFP	
TOTALS	16	8	10	9	43	1	

**TABLE 370-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	AHU-1	AHU-2	AHU-3	AHU-4	DX Cond.
Scheduled Start/Stop					X
Optimum Start/Stop					X
Duty Cycling					X
Demand Limiting					X
Day/Night Setback	X	X	X	X	
Economizer (Dry Bulb)	X	X	X	X	
Ventilation and Recirculation	X	X	X	X	
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset					
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting					
Lighting Control					



**Construction****Cost.**

The estimated cost to install the UMCS control points in Building 370 is **\$36,180**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$32,450
SIOH	\$ 1,780
Design	<u>\$ 1,950</u>
TOTAL	\$36,180

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$2,420**. Refer to Attachment 8.2A for ESA program output. Table 370-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved = 25.1 mmBtu  
(7,348 kWh x 3,413 Btu/kWh ÷  
1,000,000 Btu/mmBtu)

\$/mmBtu-Electric = \$9.60/mmBtu  
(\$240 ÷ 25.1 mmBtu)

Yearly Electric  
Demand Saved = 2.4 kW

Gas Energy Saved = 363.1 mmBtu  
(352.2 mcf x 1,031,000 Btu/mcf ÷  
1,000,000 Btu/mmBtu)

\$/mmBtu - Gas = \$3.90/mmBtu  
(\$1.400 ÷ 363.1 mmBtu)

Construction \$ = \$32,450

SIOH \$ = \$1,780

Design \$ = \$1,950

Maintenance \$ = \$550 & \$2,460

Saving to Investment Ratio (SIR)	<b>1.14</b>
Simple Payback (Years)	<b>7.42</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the overall base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 370 - NCO DINING  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 370-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	21.4			6,279		8	\$420
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	332.6	319.1		1,069		8	\$1,530
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	34.1	33.1				4	\$240
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0				2.4		\$230
Lighting Control	0.0						\$0
	0.0						\$0
<b>TOTALS</b>	<b>388.2</b>	<b>352.2</b>	<b>0</b>	<b>7,348</b>	<b>2.4</b>	<b>20</b>	<b>\$2,420</b>
		<b>\$1,400</b>	<b>\$0</b>	<b>\$240</b>	<b>\$230</b>	<b>\$550</b>	

Cost Savings Based on:

\$/mcf \$3.97  
 \$/Gal \$0.62  
 \$/kWh \$0.032  
 \$/kW \$96.28  
 \$/mh \$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      STUDY: MEADE3  
 INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      LCCID FY95 (92)  
 PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY      CENSUS: 3  
 FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 370  
 ANALYSIS DATE: 07-15-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	32450.		
B. SIOH	\$	1780.		
C. DESIGN COST	\$	1950.		
D. TOTAL COST (1A+1B+1C)	\$	36180.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$		0.	
F. PUBLIC UTILITY COMPANY REBATE	\$		0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$			36180.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	25.	\$ 236.	8.18	\$ 1930.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	363.	\$ 1398.	9.51	\$ 13294.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 230.	8.07	\$ 1856.
N. TOTAL		388.	\$ 1864.		\$ 17080.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		
(1) DISCOUNT FACTOR (TABLE A)	8.07	\$ 3010.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 24291.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 24291.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 4874.

5. SIMPLE PAYBACK PERIOD (1G/4) 7.42 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 41371.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  1.14  
 (IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 375 - MAIL ROOM AND WAREHOUSE

**Existing.** In Building 375 is not currently connected to the existing EMCS. Gas fired furnace heats the mailroom and gas fired unit heaters heat the warehouse. A separate air conditioning unit cools the mailroom.

**Proposed.** Building 375 is heated by a gas fired furnace and gas unit heater, and partially cooled by a split system air conditioning unit and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2A for building envelope and equipment. Table 375-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Gas-fired Furnace	1		2	2	5		
A/C Unit	1		1	1	3		
Lighting				1	1		
						UPC	
<b>TOTALS</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>4</b>	<b>9</b>	<b>1</b>	

**TABLE 375-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS					
	Gas Fired Furnace	A/C Unit	Lighting			
Scheduled Start/Stop		X				
Optimum Start/Stop		X				
Duty Cycling		X				
Demand Limiting		X				
Day/Night Setback	X					
Economizer (Dry Bulb)						
Ventilation and Recirculation						
Hot Deck/Cold Deck Temp. Reset						
Steam Boiler Selection						
Hot Water Boiler Selection						
Hot Water Outside Air Reset						
Chiller Selection						
Chilled Water Temp. Reset						
Chiller Demand Limiting						
Lighting Control			X			

**Construction****Cost.**

The estimated cost to install the UMCS control points in Building 375 is **\$8,890**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$7,970
SIOH	\$ 440
Design	<u>\$ 480</u>
TOTAL	\$8,890

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$770**. Refer to Attachment 8.2A for ESA program output. Table 375-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	25.5 mmBtu (7,486 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$240 ÷ 25.5 mmBtu)
Gas Energy Saved	=	81.6 mmBtu (79.1 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$310 ÷ 81.6 mmBtu)
Construction \$	=	\$7,970
SIOH \$	=	\$440

Design \$ = \$480

Maintenance \$ = \$220

Saving to Investment Ratio (SIR)	<b>0.76</b>
Simple Payback (Years)	<b>11.49</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.



**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 375 - MAIL ROOM AND WAREHOUSE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 375-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	2.1			622		4	\$130
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	81.6	79.1				4	\$420
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	23.4			6,864			\$220
	0.0						\$0
<b>TOTALS</b>	<b>107.1</b>	<b>79.1</b>	<b>0</b>	<b>7,486</b>	<b>0.0</b>	<b>8</b>	<b>\$770</b>
		<b>\$310</b>	<b>\$0</b>	<b>\$240</b>	<b>\$0</b>	<b>\$220</b>	

Cost Savings Based on:

\$/mcf \$3.97  
 \$/Gal \$0.62  
 \$/kWh \$0.032  
 \$/kW \$96.28  
 \$/mh \$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      STUDY: MEADE  
 INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      LCCID FY95 (92)  
 PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY      CENSUS: 3  
 FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 375  
 ANALYSIS DATE: 07-25-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	7970.	
B. SIOH	\$	440.	
C. DESIGN COST	\$	480.	
D. TOTAL COST (1A+1B+1C)	\$	8890.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		8890.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	26.	\$ 240.	8.18	\$ 1961.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	82.	\$ 314.	9.51	\$ 2988.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		107.	\$ 554.		\$ 4948.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		
(1) DISCOUNT FACTOR (TABLE A)	8.07	\$ 220.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 1775.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+) COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 1775.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 774.

5. SIMPLE PAYBACK PERIOD (1G/4) 11.49 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 6724.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .76$   
 (IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 393 - ADMINISTRATION

- Existing.** Building 393 is currently not connected to the existing EMCS. Gas fired furnace heats the building and a 46 ton air conditioning unit provides the cooling.
- Proposed.** Building 393 is heated and cooled by a gas-fired furnace with a DX cooling coil and an air-cooled DX compressor. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2A for building envelope and equipment. Table 393-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.
- Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Furnace	3	1	3	2	9		
Air-Cooled DX Compressor			1	1	2		
Lighting				1	1		
						UPC	
<b>TOTALS</b>	<b>3</b>	<b>1</b>	<b>4</b>	<b>4</b>	<b>12</b>	<b>1</b>	

**TABLE 393-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	Furnace	Condensing Unit	Lighting		
Scheduled Start/Stop		X			
Optimum Start/Stop		X			
Duty Cycling		X			
Demand Limiting		X			
Day/Night Setback	X				
Economizer (Dry Bulb)					
Ventilation and Recirculation	X				
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset					
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting			X		
Lighting Control					

## Construction

### Cost.

The estimated cost to install the UMCS control points in Building 393 is **\$6,650**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$5,960
SIOH	\$ 330
Design	<u>\$ 360</u>
TOTAL	\$6,650

### Savings.

The total anticipated savings by applying the before mentioned UMCS strategies is **\$3,450**. Refer to Attachment 8.2A for ESA program output. Table 393-2 shows the individual strategy savings.

### Economics.

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### LCCID Inputs

Electric Energy Saved	=	201.7 mmBtu (59,097 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$1,890 ÷ 201.7 mmBtu)
Yearly Electric Demand Saved	=	0.7 kW
Gas Energy Saved	=	331.1 mmBtu (321.2 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$1,270 ÷ 331.1 mmBtu)
Construction \$	=	\$5,960

SIOH \$ = \$330

Design \$ = \$360

Maintenance \$ = \$220

Saving to Investment Ratio (SIR)	<b>4.51</b>
Simple Payback (Years)	<b>1.92</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 393 - ADMINISTRATION  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 393-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	11.7			3,434		4	\$220
Optimum Start/Stop	0.0						\$0
Duty Cycling	7.9			2,328			\$70
Demand Limiting	0.0				0.7		\$70
Day/Night Setback	286.0	274.4		919		4	\$1,230
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	48.2	46.8					\$190
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	178.9			52,416			\$1,670
	0.0						\$0
<b>TOTALS</b>	<b>532.8</b>	<b>321.2</b>	<b>0</b>	<b>59,097</b>	<b>0.7</b>	<b>8</b>	<b>\$3,450</b>
		<b>\$1,270</b>	<b>\$0</b>	<b>\$1,890</b>	<b>\$70</b>	<b>\$220</b>	

Cost Savings Based on:

\$/mcf \$3.97  
 \$/Gal \$0.62  
 \$/kWh \$0.032  
 \$/kW \$96.28  
 \$/mh \$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 393

ANALYSIS DATE: 07-25-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	5960.	
B. SIOH	\$	330.	
C. DESIGN COST	\$	360.	
D. TOTAL COST (1A+1B+1C)	\$	6650.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		6650.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	202.	\$ 1896.	8.18	\$ 15509.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	331.	\$ 1275.	9.51	\$ 12123.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 70.	8.07	\$ 565.
N. TOTAL		533.	\$ 3241.		\$ 28197.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	220.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	1775.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 1775.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 3461.

5. SIMPLE PAYBACK PERIOD (1G/4) 1.92 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 29972.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 4.51  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 21.02 %



## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 504 - TRAINING AIDS CENTER

### Existing.

In Building 504, there are six (6) points currently connected to the existing EMCS, three (3) temperature monitoring (space temperature, return air temperature and steam supply temperature) and three start/stop points (boiler, compressor, and air conditioning fan). These points are monitoring only points. A gas fired steam boiler feeding steam unit heaters heat most of building. A cooling only packaged AHU cools the office area.

### Proposed.

Building 504 is heated by a gas-fired steam boiler supplying steam to fin tube radiation and unit heaters. Cooling is provided by various window cooling units. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2A for building envelope and equipment. Table 504-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

### Point List.

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Fin Tube Radiation	1		1	1	3		
Unit Heaters	1				1		Unit heaters will be controlled with the same points as fin tube radiation
Lighting				1	1		
						UPC	
TOTALS	2	0	1	2	5	1	

**TABLE 504-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS			
	Fin Tube Radiation	Unit Heaters	Lighting	
Scheduled Start/Stop				
Optimum Start/Stop				
Duty Cycling				
Demand Limiting				
Day/Night Setback	X	X		
Economizer (Dry Bulb)				
Ventilation and Recirculation				
Hot Deck/Cold Deck Temp. Reset				
Steam Boiler Selection				
Hot Water Boiler Selection				
Hot Water Outside Air Reset				
Chiller Selection				
Chilled Water Temp. Reset				
Chiller Demand Limiting				
Lighting Control			X	

## Construction

### Cost.

The estimated cost to install the UMCS control points in Building 504 is **\$5,090**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$4,570
SIOH	\$ 250
Design	<u>\$ 270</u>
TOTAL	\$5,090

### Savings.

The total anticipated savings by applying the before mentioned UMCS strategies is **\$2,680**. Refer to Attachment 8.2A for ESA program output. Table 504-2 shows the individual strategy savings.

### Economics.

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### LCCID Inputs

Electric Energy Saved	=	178.9 mmBtu (52,416 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$1,680 ÷ 178.9 mmBtu)
Gas Energy Saved	=	203.2 mmBtu (197.1 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$4.10/mmBtu (\$780 ÷ 197.1 mmBtu)
Construction \$	=	\$4,570
SIOH \$	=	\$250

Design \$ = \$270

Maintenance \$ = \$220 & \$730

Saving to Investment Ratio (SIR)	<b>5.67</b>
Simple Payback (Years)	<b>1.49</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 504 - TRAINING AIDES CENTER  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 504-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	203.2	197.1				8	\$1,000
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	178.9			52,416			\$1,680
	0.0						\$0
<b>TOTALS</b>	<b>382.1</b>	<b>197</b>	<b>0</b>	<b>52,416</b>	<b>0</b>	<b>8</b>	<b>\$2,680</b>
		<b>\$780</b>	<b>\$0</b>	<b>\$1,680</b>	<b>\$0</b>	<b>\$220</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE4

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 504

ANALYSIS DATE: 07-25-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	4570.	
B. SIOH	\$	250.	
C. DESIGN COST	\$	270.	
D. TOTAL COST (1A+1B+1C)	\$	5090.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		5090.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	179.	\$ 1682.	8.18	\$ 13756.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	203.	\$ 782.	9.51	\$ 7440.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		382.	\$ 2464.		\$ 21196.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	950.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	7667.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 7667.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 3414.

5. SIMPLE PAYBACK PERIOD (1G/4) 1.49 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 28862.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 5.67  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 23.83 %

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 909 - YOUTH CENTER

**Existing.** Building 909 is not currently connected to the existing EMCS. Four AHU's heat and cool the building, one each for the lobby, gym, classrooms, and office/game areas. Each unit has a DX coil and HW coil. A dedicated DX condenser serves each unit. A gas fired steam boiler with a converter provides the heat. Office and classrooms have perimeter HW baseboard radiation.

**Proposed.** Building 909 is heated and cooled by air handling units with individual DX condensing units and coils and the DOE program was used to calculate UMCS Annual Energy Savings. The ESA program was used to calculate demand limiting savings, hot water outside air reset savings and lighting savings. Refer to Attachment 8.2A for building envelope and equipment. Table 909-1 on the next page indicates the UMCS strategies, as described in Section 2, to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. The point list is based on EMCS manual TM5-815-2, January 1991.

	AI	AO	DI	DO	Total	Panel	Remarks
ACC-1	4	2	4	3	13		
ACC-2	4	2	4	3	13		
ACC-3	4	2	4	3	13		
ACC-4	4	2	4	3	13		
Stm - HW Converter	5	1		1	7		
Lighting				4	4		
						SFP, RTU	
TOTALS	21	9	16	17	63	2	

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 909 - YOUTH CENTER  
UMCS STRATEGIES  
TABLE 909-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS					
	ACC-1	ACC-2	ACC-3	ACC-4	Stm-Hw Convertor	Lighting
Scheduled Start/Stop						
Optimum Start/Stop						
Duty Cycling						
Demand Limiting	X	X	X	X		
Day/Night Setback	X	X	X	X	X	
Economizer (Dry Bulb)						
Ventilation and Recirculation	X	X	X	X		
Hot Deck/Cold Deck Temp. Reset						
Steam Boiler Selection						
Hot Water Boiler Selection						
Hot Water Outside Air Reset					X	
Chiller Selection						
Chilled Water Temp. Reset						
Chiller Demand Limiting						
Lighting Control						X



**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 909 is **\$59,870**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$53,700
SIOH	\$ 2,950
Design	<u>\$ 3,220</u>
TOTAL	\$59,870

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$5,680**. Refer to Attachment 8.2A for DOE and ESA program output. Table 909-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

LCCID Inputs

Electric Energy Saved	=	358.9 mmBtu (105,160 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$3,370 ÷ 358.9 mmBtu)
Yearly Electric Demand Saved	=	3.1 kW
Gas Energy Saved	=	426.2 mmBtu (413.4 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$1,640 ÷ 426.2 mmBtu)
Construction \$	=	\$53,700

SIOH \$ = \$2,950

Design \$ = \$3,220

Maintenance \$ = \$550

Saving to Investment Ratio (SIR)	<b>0.84</b>
Simple Payback (Years)	<b>10.21</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 909 - YOUTH CENTER  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 909-2**

UMCS Strategy	Energy Savings Summary					
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)
Scheduled Start/Stop	0.0					
Optimum Start/Stop	0.0					
Duty Cycling	0.0					
Demand Limiting	0.0				3.1	
Day/Night Setback	513.6	389.8		32,722		8
Economizer (Dry Bulb)	0.0					
Ventilation and Recirculation	28.6	4.8		6,918		8
Hot Deck/Cold Deck Temp. Reset	0.0					
Steam Boiler Selection	0.0					
Hot Water Boiler Selection	0.0					
Hot Water Outside Air Reset	19.4	18.8				4
Chiller Selection	0.0					
Chilled Water Temp. Reset	0.0					
Chiller Demand Limiting	0.0					
Lighting Control	223.6			65,520		
	0.0					
<b>TOTALS</b>	<b>785.1</b>	<b>413.4</b>	<b>0</b>	<b>105,160</b>	<b>3.1</b>	<b>20</b>
		<b>\$1,640</b>	<b>\$0</b>	<b>\$3,370</b>	<b>\$300</b>	<b>\$550</b>
						<b>\$5,910</b>

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 909

ANALYSIS DATE: 07-25-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	53700.		
B. SIOH	\$	2950.		
C. DESIGN COST	\$	3220.		
D. TOTAL COST (1A+1B+1C)	\$	59870.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		59870.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	359.	\$ 3374.	8.18	\$ 27597.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	426.	\$ 1641.	9.51	\$ 15605.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 300.	8.07	\$ 2421.
N. TOTAL		785.	\$ 5315.		\$ 45622.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	550.
(1) DISCOUNT FACTOR (TABLE A)	8.07		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	4439.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 4439.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 5865.

5. SIMPLE PAYBACK PERIOD (1G/4) 10.21 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 50061.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = .84  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 2.25 %

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 940 - MORALE SUPPORT OFFICE

### Existing.

In Building 940, there are six (6) points currently connected to the existing EMCS; three (3) temperature monitoring (space temperature, return air temperature, and steam supply temperature) and three (3) start/stop points (boiler, AHU and compressor). These points are monitoring only points. The office area is conditioned by an AHU with a steam coil and a DX coil with an outdoor condenser. The rest of building is heated only by steam unit heaters. An oil fired steam boiler provides steam.

### Proposed.

Building 940 is heated by steam unit heaters and the office area is heated and cooled by a packaged split system air handling unit. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2A for building envelope and equipment. Table 940-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

### Point List.

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
AHU	4	2	3	3	12		No outdoor air damper
Steam Unit Heaters	2		1	1	4		
						UPC	
TOTALS	6	2	4	4	16	1	

## TABLE 940-1

00

## Construction

### Cost.

The estimated cost to install the UMCS control points in Building 940 is **\$9,180**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Material	\$8,240
SIOH	\$ 450
Design	<u>\$ 490</u>
TOTAL	\$9,180

### Savings.

The total anticipated savings by applying the before mentioned UMCS strategies is **\$2,530**. Refer to Attachment 8.2A for ESA program output. Table 940-2 shows the individual strategy savings.

### Economics.

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### LCCID Inputs

Electric Energy Saved	=	18.8 mmBtu (5,519 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.60/mmBtu (\$180 ÷ 18.8 mmBtu)
Yearly Electric Demand Saved	=	0.3 kW
Oil Energy Saved	=	469.8 mmBtu (3,387 gal x 138,700 Btu/gal ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Oil	=	\$4.50/mmBtu (\$2,100 ÷ 469.8 mmBtu)
Construction \$	=	\$8,240

SIOH \$ = \$450

Design \$ = \$490

Maintenance \$ = \$220 & \$730

Saving to Investment Ratio (SIR)	3.24
Simple Payback (Years)	2.81

**Discussion.** The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.



**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 940 - MORALE SUPPORT OFFICE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 940-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	137.6		882	4,472		4	\$810
Optimum Start/Stop	0.0						\$0
Duty Cycling	3.6			1,047			\$30
Demand Limiting	0.0				0.3		\$30
Day/Night Setback	347.4		2,505			4	\$1,660
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
	0.0						\$0
<b>TOTALS</b>	<b>489</b>	<b>0</b>	<b>3,387</b>	<b>5,519</b>	<b>0.3</b>	<b>8</b>	<b>\$2,530</b>

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 940

ANALYSIS DATE: 07-15-96      ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	8240.		
B. SIOH	\$	450.		
C. DESIGN COST	\$	490.		
D. TOTAL COST (1A+1B+1C)	\$	9180.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$		0.	
F. PUBLIC UTILITY COMPANY REBATE	\$		0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$			9180.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	19.	\$ 177.	8.18	\$ 1446.
B. DIST	\$ 4.50	470.	\$ 2114.	9.64	\$ 20380.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	0.	\$ 0.	9.51	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 30.	8.07	\$ 242.
N. TOTAL		489.	\$ 2321.		\$ 22068.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		
(1) DISCOUNT FACTOR (TABLE A)	8.07	\$ 950.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 7667.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
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d. TOTAL	\$	0.		0.
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C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4)	\$	7667.
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4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$	\$	3271.
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5. SIMPLE PAYBACK PERIOD (1G/4)	2.81 YEARS
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6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	\$	29734.
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7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) =	3.24
(IF < 1 PROJECT DOES NOT QUALIFY)	

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):	17.08 %
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**BUILDING BY BUILDING UMCS ANALYSIS**  
**BUILDING 1978 - ADMINISTRATIVE and**  
**BUILDING 1976 - WAREHOUSE**

**Existing.**

Buildings 1978 and 1976 are not currently connected to the existing EMCS. Steam unit heaters with steam supplied from building 1978 heat building 1976. Two VAV AHU's heat and cool most of building 1978 with one single zone AHU serving the southwest corner. A gas fired steam boiler provides steam for heat. Air cooled DX chiller is dedicated to each AHU.

**Proposed.**

Building 1976 is a warehouse which is heated by steam unit heaters. The steam is supplied from steam boilers in Building 1978. Building 1976 will be combined with Building 1978 since they are connected and 1978 supplies heat to 1976. Building 1978 is heated and cooled by two VAV air handling units. Heating is provided by two steam boilers and cooling is provided by an air cooled DX condensing unit. The Information Center addition to 1978 has a dedicated hot water boiler and a single air handling unit with the cooling being out of service. The Information Center will be included as part of 1978.

The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2A for building envelope and equipment. Table 1978-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

## TABLE 1978-1

UMCS Strategy	Mechanical Systems Controlled By UMCS						Unit
	AHU-1	AHU-2	AHU-3	S-W Conv	Hot Water Boiler	Steam Unit Heaters	
Scheduled Start/Stop							X
Optimum Start/Stop							X
Duty Cycling							X
Demand Limiting							X
Day/Night Setback	X	X	X	X		X	
Economizer (Dry Bulb)	X	X	X				
Ventilation and Recirculation	X	X	X				
Hot Deck/Cold Deck Temp. Reset							
Steam Boiler Selection							
Hot Water Boiler Selection							
Hot Water Outside Air Reset				X	X		
Chiller Selection							
Chilled Water Temp. Reset							
Chiller Demand Limiting							
Lighting Control							

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	8			2	10		
AHU-2	8			2	10		
AHU-3	3	2	2	1	8		Unit is heating only
Steam toHW Converter	5	1		1	7		
Air Cooled Condenser	1		1	1	3		
Hot Water Boiler	8	1	1	2	12		
Steam Unit Heaters	2		1	1	4		
Lighting				4	4		
						SFP	
TOTALS	35	4	5	14	58	1	

**Construction  
Cost.**

The estimated cost to install the UMCS control points in Buildings 1978 and 1976 is **\$75,900**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$68,080
SIOH	\$ 3,740
Design	<u>\$ 4,080</u>
TOTAL	\$75,900

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$11,468**. Refer to Attachment 8.2A for ESA program output. Table 1978-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved = 713.7 mmBtu  
(209,099 kWh x 3,413 Btu/kWh ÷  
1,000,000 Btu/mmBtu)

\$/mmBtu-Electric = \$9.40/mmBtu  
(\$6,690 ÷ 713.7 mmBtu)

Yearly Electric  
Demand Saved = 6.0 kW

Gas Energy Saved = 887.7 mmBtu  
(860.6 mcf x 1,031,000 Btu/mcf ÷  
1,000,000 Btu/mmBtu)

\$/mmBtu - Gas = \$3.80/mmBtu  
(\$3,420 ÷ 887.7 mmBtu)

Construction \$ = \$68,080

SIOH \$ = \$3,740

Design \$ = \$4,080

Maintenance \$ = \$780

Saving to Investment Ratio (SIR)	<b>1.29</b>
Simple Payback (Years)	<b>6.61</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 1978 - ADMINISTRATIVE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 1978-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	13.4			3,925		4	\$240
Optimum Start/Stop	0.0						\$0
Duty Cycling	15.9			4,655		4	\$260
Demand Limiting	0.0				6.0		\$580
Day/Night Setback	614.3	593.1		839		8	\$2,600
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	49.8	48.3				4	\$300
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	226.0	219.2				8	\$1,090
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	681.5			199,680			\$6,390
	0.0						\$0
<b>TOTALS</b>	<b>1,600.9</b>	<b>860.6</b>	<b>0</b>	<b>209,099</b>	<b>6.0</b>	<b>28</b>	<b>\$11,460</b>
		<b>\$3,420</b>	<b>\$0</b>	<b>\$6,690</b>	<b>\$580</b>	<b>\$770</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 1978

ANALYSIS DATE: 07-25-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	68080.	
B. SIOH	\$	3740.	
C. DESIGN COST	\$	4080.	
D. TOTAL COST (1A+1B+1C)	\$	75900.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	75900.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	714.	\$ 6709.	8.18	\$ 54878.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	888.	\$ 3418.	9.51	\$ 32502.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 580.	8.07	\$ 4681.
N. TOTAL		1601.	\$ 10706.		\$ 92060.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$ 770.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 6214.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 6214.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 11476.

5. SIMPLE PAYBACK PERIOD (1G/4) 6.61 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 98274.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  1.29  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 6.82 %



## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 2212 - ADMINISTRATIVE

#### Existing.

In Building 2212, there are six (6) points currently connected to the existing EMCS, two (2) temperature monitoring (space temperature and outside air temperature), one (1) humidity monitoring point, and three (3) start/stop points (Boiler, AHU-1, and AHU-2). The boiler has been deleted because it is no longer in service. The only control is for proof-of-run monitoring or occupied/unoccupied cycling on the start/stop points. Two AHU's cool the building in the summer with a DX air cooled condenser. Electric radiation heats the building. A separate heat pump unit serves the executive offices.

#### Proposed.

Building 2212 is heated by electric baseboard radiation and cooled by three air handling units with DX coils and condensing units. Only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2A for building envelope and equipment schedules. Table 2212-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

#### Point List.

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. The point list is based on EMCS manual TM5-815-2, January 1991.

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	4	2	3	3	12		
AHU-2	4	2	3	3	12		
HP-1	4	2	3	3	12		
Lighting				4	4		
						SFP	
TOTALS	12	6	9	13	40	1	

**TABLE 2212-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS			
	AHU-1	AHU-2	HP-1	Lighting
Scheduled Start/Stop	X	X	X	
Optimum Start/Stop	X	X	X	
Duty Cycling				
Demand Limiting				
Day/Night Setback				
Economizer (Dry Bulb)				
Ventilation and Recirculation				
Hot Deck/Cold Deck Temp. Reset				
Steam Boiler Selection				
Hot Water Boiler Selection				
Hot Water Outside Air Reset				
Chiller Selection				
Chilled Water Temp. Reset				
Chiller Demand Limiting				X
Lighting Control				

## **Construction**

### **Cost.**

The estimated cost to install the UMCS control points in Building 2212 is **\$29,910**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Constuction	\$26,820
SIOH	\$ 1,480
Design	<u>\$ 1,610</u>
TOTAL	\$29,910

### **Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$1,980**. Refer to Attachment 8.2A for ESA program output. Table 2212-2 shows the individual strategy savings.

### **Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### **LCCID Inputs**

Electric Energy Saved	=	175.9 mmBtu (51,531 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$1,600 ÷ 175.9 mmBtu)
Construction \$	=	\$26,820
SIOH \$	=	\$1,480
Design \$	=	\$1,610
Maintenance \$	=	\$300 & \$730

Saving to Investment Ratio (SIR)	<b>0.74</b>
Simple Payback (Years)	<b>11.02</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2212 - ADMINISTRATIVE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 2212-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	99.2			29,067		12	\$1,260
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	0.0						\$0
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	76.7			22,464			\$720
	0.0						\$0
<b>TOTALS</b>	<b>175.9</b>	<b>0</b>	<b>0</b>	<b>51,531</b>	<b>0</b>	<b>12</b>	<b>\$1,980</b>
		<b>\$0</b>	<b>\$0</b>	<b>\$1,650</b>	<b>\$0</b>	<b>\$330</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 2212

ANALYSIS DATE: 07-25-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	26820.	
B. SIOH	\$	1480.	
C. DESIGN COST	\$	1610.	
D. TOTAL COST (1A+1B+1C)	\$	29910.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	29910.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	176.	\$ 1653.	8.18	\$ 13525.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	0.	\$ 0.	9.51	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		176.	\$ 1653.		\$ 13525.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	1060.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	8554.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 8554.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 2713.

5. SIMPLE PAYBACK PERIOD (1G/4) 11.02 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 22080.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = .74  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 2220 - REPAIR SHOP AND OFFICE

- Existing.** In Building 2220, there are seven (7) points currently connected to the existing EMCS, four (4) temperature monitoring (space temperature, two air temperature, and steam supply temperature) and three (3) start/stop points (Boiler, AHU, and condensing unit). These seven points are monitoring points only. An oil fired steam boiler supplies steam unit heaters and a packaged AHU with DX cooling serves the office. Window A/C units cool other offices.
- Proposed.** Building 2220 is heated by unit heaters and radiators and cooled by a split-system A/C unit and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2A for building envelope and equipment. Table 2220-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.
- Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
AC-1	4	2	3	3	12		O.A. damper not included due to small unit size
HV-1	3	2	2	1	8		
Unit Heaters	2		1	1	4		
Lighting				2	2		
						RTU	
TOTALS	9	4	6	7	26	1	

**TABLE 2220-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	A/C-1	HV-1	Unit Heaters		
Scheduled Start/Stop	X				
Optimum Start/Stop	X				
Duty Cycling	X				
Demand Limiting	X				
Day/Night Setback		X	X		
Economizer (Dry Bulb)	X				
Ventilation and Recirculation	X	X			
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset					
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting					
Lighting Control					



## Construction

### Cost.

The estimated cost to install the UMCS control points in Building 2220 is **\$21,000**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$18,830
SIOH	\$ 1,040
Design	<u>\$ 1,130</u>
TOTAL	\$21,000

### Savings.

The total anticipated savings by applying the before mentioned UMCS strategies is **\$3,500**. Refer to Attachment 8.2A for ESA program output. Table 2220-2 shows the individual strategy savings.

### Economics.

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### LCCID Inputs

Electric Energy Saved	=	199.5 mmBtu (58,440 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$1,870 ÷ 199.5 mmBtu)
Oil Energy Saved	=	289.7 mmBtu (2,089 gal x 138,700 Btu/gal ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$4.50/mmBtu (\$1,300 ÷ 289.7 mmBtu)
Construction \$	=	\$18,830
SIOH \$	=	\$1,040

Design \$ = \$1,130

Maintenance \$ = \$330 & \$860

Saving to Investment Ratio (SIR)	<b>1.79</b>
Simple Payback (Years)	<b>4.81</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2220 - REPAIR SHOP AND OFFICE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 2220-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	3.5			1,032		4	\$140
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	281.8		2,031			4	\$1,370
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	8.0		57			4	\$150
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	195.9			57,408			\$1,840
	0.0						\$0
<b>TOTALS</b>	<b>489.2</b>	<b>0</b>	<b>2,089</b>	<b>58,440</b>	<b>0.0</b>	<b>12</b>	<b>\$3,500</b>

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 2220

ANALYSIS DATE: 07-25-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	18830.	
B. SIOH	\$	1040.	
C. DESIGN COST	\$	1130.	
D. TOTAL COST (1A+1B+1C)	\$	21000.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		21000.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	200.	\$ 1875.	8.18	\$ 15340.
B. DIST	\$ 4.50	290.	\$ 1304.	9.64	\$ 12567.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	0.	\$ 0.	9.51	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		489.	\$ 3179.		\$ 27907.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	1190.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	9603.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 9603.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 4369.

5. SIMPLE PAYBACK PERIOD (1G/4) 4.81 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 37510.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 1.79  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 10.32 %

## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 2234 - ADMINISTRATIVE

**Existing.**

In Building 2234, there are eight (8) points currently connected to the existing EMCS, two (2) temperature monitoring (space temperature and dual temperature water supply temperature) and five start/stop points (2 boilers, 2 pumps, and 1 chiller). These points are monitoring only points. Two pipe fan coils heat and cool the building with no outdoor air. A gas fired hot-water boiler provides hot water and a 100-ton air cooled chiller provides chilled water.

**Proposed.**

Building 2234 is heated by two gas-fired hot water boilers and cooled by an air-cooled chiller. Dual temperature water piping supplies either hot or chilled water to fan coil units. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2A for building envelope and equipment. Table 2234-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Boiler	5	1	4	2	12		
Chiller	7		4	4	15		
Fan Coil	2			2	4		
Lighting				3	3		
						SFP	
TOTALS	14	1	8	11	34	1	

**TABLE 2234-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	Fan Coils	Hot Water Boiler	Air Cooled Chiller	Lighting	
Scheduled Start/Stop			X		
Optimum Start/Stop			X		
Duty Cycling					
Demand Limiting					
Day/Night Setback	X				
Economizer (Dry Bulb)					
Ventilation and Recirculation					
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset		X			
Chiller Selection					
Chilled Water Temp. Reset			X		
Chiller Demand Limiting					
Lighting Control				X	

## Construction

### Cost.

The estimated cost to install the UMCS control points in Building 2234 is **\$51,250**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$45,960
SIOH	\$ 2,530
Design	<u>\$ 2,760</u>
TOTAL	\$51,250

### Savings.

The total anticipated savings by applying the before mentioned UMCS strategies is **\$5,940**. Refer to Attachment 8.2A for ESA program output. Table 2234-2 shows the individual strategy savings.

### Economics.

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### LCCID Inputs

Electric Energy Saved	=	461 mmBtu (134,934 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.30/mmBtu (\$4,320 ÷ 461 mmBtu)
Gas Energy Saved	=	338 mmBtu (328 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.85/mmBtu (\$1,300 ÷ 338 mmBtu)
Construction \$	=	\$45,960
SIOH \$	=	\$2,530

Design \$ = \$2,760

Maintenance \$ = \$330 & \$980

Saving to Investment Ratio (SIR)	<b>1.14</b>
Simple Payback (Years)	<b>7.38</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.



**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2234 - ADMINISTRATIVE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 2234-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	13.4			3,925		2	\$180
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	177.8	169.0		1,052		4	\$810
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	163.9	159.0				4	\$740
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	17.6			5,157		2	\$220
Chiller Demand Limiting	0.0						\$0
Lighting Control	425.9			124,800			\$3,990
	0.0						\$0
<b>TOTALS</b>	<b>798.7</b>	<b>328.0</b>	<b>0</b>	<b>134,934</b>	<b>0.0</b>	<b>12</b>	<b>\$5,940</b>
		<b>\$1,300</b>	<b>\$0</b>	<b>\$4,320</b>	<b>\$0</b>	<b>\$330</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID    FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS.    3    CENSUS:    3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 2234

ANALYSIS DATE: 07-25-96    ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	45960.	
B. SIOH	\$	2530.	
C. DESIGN COST	\$	2760.	
D. TOTAL COST (1A+1B+1C)	\$	51250.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	51250.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	461.	\$ 4333.	8.18	\$ 35447.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	338.	\$ 1301.	9.51	\$ 12375.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		799.	\$ 5635.		\$ 47823.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 1310.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 10572.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)\$ 10572.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$ \$ 6945.

5. SIMPLE PAYBACK PERIOD (1G/4) 7.38 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 58394.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 1.14  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 5.47 %

**BUILDING BY BUILDING UMCS ANALYSIS  
BUILDING 2251 - BOILER PLANT**

**Existing.** Building 2251 is not connected to the exiting EMCS.

**Discussion.** Building 2251 is a steam boiler plant that serviced several buildings. The Plant has been out of service for the past two years. The buildings to which this plant previously provided steam now have their own heat sources. Fort Meade has no plans to restore this plant to operation. Therefore, is it not recommended that this building be included with the new UMCS. Four steam boilers supplied steam to a few buildings.

## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 2253 - VEHICLE MAINTENANCE SHOP

**Existing.** In Building 2253, there are three (3) points currently connected to the existing EMCS, two (2) temperature monitoring (high and low space temperature) and one (1) start/stop points (furnace). These three EMCS points are monitoring points only. A gas fired furnace heats the building and there is no cooling in building.

**Proposed.** Building 2253 is heated and cooled by gas fired furnace and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2A for building envelope and equipment. Table 2253-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Gas Fired Furnace	2		1	2	5		
Lighting				1	1		
						UPC	
TOTALS	2	0	1	3	6	1	

**TABLE 2253-1**

[illegible]

## Construction

### Cost.

The estimated cost to install the UMCS control points in Building 2253 is **\$4,590**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$4,110
SIOH	\$ 230
Design	<u>\$ 250</u>
TOTAL	\$4,590

### Savings.

The total anticipated savings by applying the before mentioned UMCS strategies is **\$1,940**. Refer to Attachment 8.2A for ESA program output. Table 2253-2 shows the individual strategy savings.

### Economics.

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### LCCID Inputs

Electric Energy Saved	=	119.3 mmBtu (34,944 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$1,120 ÷ 119.3 mmBtu)
Gas Energy Saved	=	185.3 mmBtu (179.7 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$710 ÷ 185.3 mmBtu)
Construction \$	=	\$4,110
SIOH \$	=	\$230

Design \$ = \$250

Maintenance \$ = \$110 & \$370

Saving to Investment Ratio (SIR)	<b>4.32</b>
Simple Payback (Years)	<b>1.98</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2253 - VEHICLE MAINTENANCE SHOP  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 2253-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	185.3	179.7				4	\$820
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	119.3			34,944			\$1,120
	0.0						\$0
<b>TOTALS</b>	<b>304.5</b>	<b>179.7</b>	<b>0</b>	<b>34,944</b>	<b>0.0</b>	<b>4</b>	<b>\$1,940</b>
		<b>\$710</b>	<b>\$0</b>	<b>\$1,120</b>	<b>\$0</b>	<b>\$110</b>	

Cost Savings Based on:

\$/mcf \$3.97  
 \$/Gal \$0.62  
 \$/kWh \$0.032  
 \$/kW \$96.28  
 \$/mh \$27.50



LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID    FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS.    3    CENSUS:    3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 2253

ANALYSIS DATE:    07-25-96    ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	4110.	
B. SIOH	\$	230.	
C. DESIGN COST	\$	250.	
D. TOTAL COST (1A+1B+1C)	\$	4590.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		4590.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	119.	\$ 1121.	8.18	\$ 9173.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	185.	\$ 713.	9.51	\$ 6784.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		305.	\$ 1835.		\$ 15958.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	480.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	3874.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 3874.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 2315.

5. SIMPLE PAYBACK PERIOD (1G/4) 1.98 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 19831.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 4.32  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 20.50 %

## **BUILDING BY BUILDING UMCS ANALYSIS**

### **BUILDING 2257 - ADMINISTRATIVE**

- Existing.** In Building 2257, there are eight (8) points currently connected to the existing EMCS, three (3) temperature monitoring (space temperature, supply air temperature, and dual temperature water supply temperature) , one (1) open/close point (dual temperature changeover valve) and four (4) start/stop points (boiler #1, boiler #2, dual temperature pump, and AHU-1). The only control of the four start/stop points is occupied/unoccupied scheduling control. The changeover valve point is a monitoring only point. Two-pipe ceiling mounted fan coil units condition building. A basement 100% outdoor air unit supplies fresh air to each floor. Two gas fired hot water boilers and a 90 ton air cooled chiller provides hot and chilled water.
- Proposed.** Building 2257 is heated and cooled by Fan-coil-units and only the ESA program was used to calculate UMCS Annual Energy Savings. There is a large air handling unit providing 100% outdoor air to the fan coil units. Refer to Attachment 8.2A for building envelope and equipment schedules. Table 2257-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.
- Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. The point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

## UMCS FEASIBILITY STUDY

UMCS Strategy	Mechanical Systems Controlled By UMCS					
	Fan Coils	Hot Water Boilers	AHU-1	AHU-2	Air Cooled Chiller	Lighting
Scheduled Start/Stop			X	X	X	
Optimum Start/Stop				X	X	
Duty Cycling						
Demand Limiting						
Day/Night Setback	X					
Economizer (Dry Bulb)				X		
Ventilation and Recirculation				X		
Hot Deck/Cold Deck Temp. Reset						
Steam Boiler Selection						
Hot Water Boiler Selection						
Hot Water Outside Air Reset		X				
Chiller Selection						
Chilled Water Temp. Reset					X	
Chiller Demand Limiting						X
Lighting Control						

	AI	AO	DI	DO	Total	Panel	Remarks
Fan Coil Units			3	3	6		
Hot Water Boilers	9	2	5	3	19		
Air Cooled Chiller	7		4	4	15		
AHU-1	4		1	2	7		
AHU-2	4		1	2	7		
Lighting				8	8		
						SFP,RTU	
TOTALS	24	2	14	22	62	2	

**Construction Cost.**

The estimated cost to install the UMCS control points in Building 2257 is **\$88,610**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Consturction	\$79,470
SIOH	\$ 4,370
Design	<u>\$ 4,770</u>
TOTAL	\$88,610

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$11,150**. Refer to Attachment 8.2A for ESA program output. Table 2257-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

### LCCID Inputs

Electric Energy Saved	=	535.4 mmBtu (156,867 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.30/mmBtu (\$5,020 ÷ 535.4 mmBtu)
Gas Energy Saved	=	1,503 mmBtu (1,458.1 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$5,790 ÷ 1,503 mmBtu)
Construction \$	=	\$79,470
SIOH \$	=	\$4,370
Design \$	=	\$4,770
Maintenance \$	=	\$440 & \$980

Saving to Investment Ratio (SIR)	1.21
Simple Payback (Years)	7.24

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2257 - ADMINISTRATIVE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 2257-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	1,135.9	1,016.1		25,866			\$4,900
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	314.3	298.7		1,858		4	\$1,400
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	7.7	7.5				4	\$100
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	140.0	135.8				4	\$600
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	14.8			4,343		4	\$150
Chiller Demand Limiting	0.0						\$0
Lighting Control	425.9			124,800			\$4,000
	0.0						\$0
<b>TOTALS</b>	<b>2,038.7</b>	<b>1,458.1</b>	<b>0</b>	<b>156,867</b>	<b>0.0</b>	<b>16</b>	<b>\$11,150</b>
		<b>\$5,790</b>	<b>\$0</b>	<b>\$5,020</b>	<b>\$0</b>	<b>\$440</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID    FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS.    3    CENSUS: 3

PROJECT NO. & TITLE: 4130.07    UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 2257

ANALYSIS DATE: 07-25-96    ECONOMIC LIFE 10 YEARS    PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	79470.		
B. SIOH	\$	4370.		
C. DESIGN COST	\$	4770.		
D. TOTAL COST (1A+1B+1C)	\$	88610.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		88610.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	535.	\$ 5033.	8.18	\$ 41168.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	1503.	\$ 5787.	9.51	\$ 55030.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		2038.	\$ 10819.		\$ 96198.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	1420.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	11459.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 11459.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 12239.

5. SIMPLE PAYBACK PERIOD (1G/4) 7.24 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 107657.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 1.21  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 6.15 %

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 2282 - ADMINISTRATIVE R & D

**Existing.** Building 2282 is currently not connected to the existing EMCS. A two-pipe system of AHU's and fan coils heat and cool the building. A gas fired hot water boiler and two 20 ton air cooled chillers provide hot and chilled water.

**Proposed.** Building 2282 is heated by a gas-fired hot water boiler and cooled by two (2) air-cooled chillers. Dual temperature piping supplies either hot or chilled water to fan coil units. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2A for building envelope and equipment. Table 2282-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Chiller	9		6	6	21		
Boiler	5	1	4	2	12		
Fan Coil			2	2	4		
Lighting				2	2		
						RTU	
TOTALS	14	1	12	12	39	1	



**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2282 - ADMINISTRATIVE R & D  
UMCS STRATEGIES  
TABLE 2282-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	Fan Coils	Boiler	Chillers	Lighting	
Scheduled Start/Stop			X		
Optimum Start/Stop			X		
Duty Cycling					
Demand Limiting					
Day/Night Setback	X				
Economizer (Dry Bulb)					
Ventilation and Recirculation					
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset		X			
Chiller Selection					
Chilled Water Temp. Reset			X		
Chiller Demand Limiting					
Lighting Control				X	

**Construction****Cost.**

The estimated cost to install the UMCS control points in Building 2282 is **\$53,710**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$48,170
SIOH	\$ 2,650
Design	<u>\$ 2,890</u>
TOTAL	\$53,710

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$2,740**. Refer to Attachment 8.2A for ESA program output. Table 2282-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	192.1 mmBtu (56,274 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$1,800 ÷ 192.1 mmBtu)
Gas Energy Saved	=	158 mmBtu (153.3 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$610 ÷ 158 mmBtu)
Construction \$	=	\$48,170
SIOH \$	=	\$2,650

Design \$ = \$2,890

Maintenance \$ = \$330

Saving to Investment Ratio (SIR)	<b>0.43</b>
Simple Payback (Years)	<b>19.57</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2282 - ADMINISTRATIVE R&D  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 2282-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	17.9			5,233		4	\$280
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	146.2	138.8		921		4	\$690
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	14.9	14.5				4	\$170
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	7.8			2,280			\$70
Chiller Demand Limiting	0.0						\$0
Lighting Control	163.3			47,840			\$1,530
	0.0						\$0
<b>TOTALS</b>	<b>350.1</b>	<b>153.3</b>	<b>0</b>	<b>56,274</b>	<b>0.0</b>	<b>12</b>	<b>\$2,740</b>
		<b>\$610</b>	<b>\$0</b>	<b>\$1,800</b>	<b>\$0</b>	<b>\$330</b>	

Cost Savings Based on:

\$/mcf \$3.97  
 \$/Gal \$0.62  
 \$/kWh \$0.032  
 \$/kW \$96.28  
 \$/mh \$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 2282

ANALYSIS DATE: 07-25-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	48170.	
B. SIOH	\$	2650.	
C. DESIGN COST	\$	2890.	
D. TOTAL COST (1A+1B+1C)	\$	53710.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	53710.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	192.	\$ 1806.	8.18	\$ 14771.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	158.	\$ 608.	9.51	\$ 5785.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		350.	\$ 2414.		\$ 20556.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$ 330.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 2663.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 2663.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 2744.

5. SIMPLE PAYBACK PERIOD (1G/4) 19.57 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 23219.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = .43  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): -4.27 %

## **BUILDING BY BUILDING UMCS ANALYSIS**

### **BUILDING 2481 - UEPH**

- Existing.** In Building 2481, there are nine (9) points currently connected to the existing EMCS, five (5) temperature monitoring (1 space temperature, (2) hot and cold deck temperatures, and 2 air temperatures) and four (4) start/stop points (2 pumps, AHU, and condensing unit). These points are monitoring only points. A multi-zone AHU with a 30 ton DX coil cold deck and hot water hot deck condition the building. Fin tube radiation is used for skin loss.
- Proposed.** Building 2481 is heated and cooled by a single multi-zone air handling unit and only the ESA program was used to calculate UMCS Annual Energy Savings. The building is a residence and must operate in occupied mode 24 hours per day. Hot deck/cold deck temperature reset control will be applied to the multi-zone air handling unit. Refer to Attachment 8.2A for building envelope and equipment. Table 2481-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.
- Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

**TABLE 2481-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	AHU-1	Condensing Unit	S-W Conv		
Scheduled Start/Stop					
Optimum Start/Stop					
Duty Cycling		X			
Demand Limiting		X			
Day/Night Setback					
Economizer (Dry Bulb)					
Ventilation and Recirculation					
Hot Deck/Cold Deck Temp. Reset	X				
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset			X		
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting					
Lighting Control					

	AI	AO	DI	DO	Total	Panel	Remarks
AHU (Multi-zone)	7	2	1	2	12		
Steam HW Convertor	5	1		1	7		
Air Cooled Condensing Unit	1		1	1	3		
						SFP	
TOTALS	13	3	2	4	22	1	

**Construction Cost.**

The estimated cost to install the UMCS control points in Building 2481 is **\$18,590**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$16,670
SIOH	\$ 920
Design	<u>\$ 1,000</u>
TOTAL	\$18,590

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$5,000**. Refer to Attachment 8.2A for ESA program output. Table 2481-2 shows the individual strategy savings.

This building is heated by steam which is supplied by the Boiler Plant, Building 2482. The heating savings shown are based on boiler fuel oil savings and an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses to and from the building. The heating fuel savings are in oil since the boilers are oil-fired only.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).



### LCCID Inputs

Electric Energy Saved = 210.5 mmBtu  
(61,683 kWh x 3,413 Btu/kWh ÷  
1,000,000 Btu/mmBtu)

\$/mmBtu-Electric = \$9.40/mmBtu  
(\$2,970 ÷ 210.5 mmBtu)

Yearly Electric  
Demand Savings = 4.5 kW

Oil Energy Saved = 507.5 mmBtu  
(3,662 gal x 138,700 Btu/gal ÷  
1,000,000 Btu/mmBtu)

\$ gal - Oil = \$4.50/mmBtu  
(\$2,270 ÷ 507.5 mmBtu)

Construction \$ = \$16,670

SIOH \$ = \$920

Design \$ = \$1,000

Maintenance \$ = \$330 & \$1,110

Saving to Investment Ratio (SIR)	2.87
Simple Payback (Years)	3.03

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2481 - UEPH  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 2481-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	133.5			39,102		4	\$1,360
Demand Limiting	0.0				4.5		\$430
Day/Night Setback	0.0						\$0
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	457.7		2,744	22,581		4	\$2,530
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	127.3		918			4	\$680
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
<b>TOTALS</b>	<b>718.4</b>	<b>0</b>	<b>3,662</b>	<b>61,683</b>	<b>4.5</b>	<b>12</b>	<b>\$5,000</b>

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 2481

ANALYSIS DATE: 07-15-96      ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	16670.		
B. SIOH	\$	920.		
C. DESIGN COST	\$	1000.		
D. TOTAL COST (1A+1B+1C)	\$	18590.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$		0.	
F. PUBLIC UTILITY COMPANY REBATE	\$		0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$			18590.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	211.	\$ 1979.	8.18	\$ 16186.
B. DIST	\$ 4.50	508.	\$ 2284.	9.64	\$ 22015.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	0.	\$ 0.	9.51	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 430.	8.07	\$ 3470.
N. TOTAL		718.	\$ 4692.		\$ 41671.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 1440.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 11621.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
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d. TOTAL	\$ 0.			0.
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C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)	\$ 11621.
--	-----------

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$	\$ 6132.
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5. SIMPLE PAYBACK PERIOD (1G/4)	3.03 YEARS
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6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	\$ 53292.
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7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) =	2.87
(IF < 1 PROJECT DOES NOT QUALIFY)	

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):	15.66 %
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## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 2482 - BOILER PLANT

**Existing.** Building 2482 is not currently connected to the existing EMCS. Three 400 BHP oil fired boilers provide 90 psi steam to buildings 2481, 2490, 2484 and the Hospital 2480 only.

**Proposed.** Building 2482 is a steam boiler plant which provides steam to over 10 buildings. This includes the Hospital and Buildings 2481, 2482, and 2490, which are part of the study. The steam boiler selection strategy is the only applicable strategy for this building. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2A for building envelope and equipment. Table 2482-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Boiler #1	9		2	1	12		
Boiler #2	9		2	1	12		
Boiler #3	9		2	1	12		
Common Points	1		2		3		
						RTU	
TOTALS	28	0	8	3	39	1	

**TABLE 2482-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS						
	Steam Boiler						
Scheduled Start/Stop							
Optimum Start/Stop							
Duty Cycling							
Demand Limiting							
Day/Night Setback							
Economizer (Dry Bulb)							
Ventilation and Recirculation							
Hot Deck/Cold Deck Temp. Reset							
Steam Boiler Selection	X						
Hot Water Boiler Selection							
Hot Water Outside Air Reset							
Chiller Selection							
Chilled Water Temp. Reset							
Chiller Demand Limiting							
Lighting Control							

**Construction****Cost.**

The estimated cost to install the UMCS control points in Building 2482 is **\$295,370**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$264,910
SIOH	\$ 14,570
Design	<u>\$ 15,890</u>
TOTAL	\$295,370

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$2,820**. Refer to Attachment 8.2A for ESA program output. Table 2482-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Oil Energy Saved	=	556.2 mmBtu (4,010 gal x 138,700 Btu/gal ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Oil	=	\$6.70/mmBtu (\$2,490 ÷ 370.7 mmBtu)
Construction \$	=	\$264,910
SIOH \$	=	\$14,570
Design \$	=	\$15,890
Maintenance \$	=	\$330

Saving to Investment Ratio (SIR)	<b>0.09</b>
Simple Payback (Years)	<b>104.26</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2482 - BOILER PLANT  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 2482-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	0.0						\$0
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	556.2		4,010			12	\$2,820
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
TOTALS	556.2	0	4,010	0	0	12	\$2,820
		\$0	\$2,490	\$0	\$0	\$330	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50



LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 2482

ANALYSIS DATE: 07-10-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	264910.	
B. SIOH	\$	14570.	
C. DESIGN COST	\$	15890.	
D. TOTAL COST (1A+1B+1C)	\$	295370.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		295370.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	0.	\$ 0.	8.18	\$ 0.
B. DIST	\$ 4.50	556.	\$ 2503.	9.64	\$ 24128.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	0.	\$ 0.	9.51	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		556.	\$ 2503.		\$ 24128.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	330.
(1) DISCOUNT FACTOR (TABLE A)	8.07		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	2663.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 2663.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 2833.

5. SIMPLE PAYBACK PERIOD (1G/4) 104.26 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 26791.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .09$   
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): -18.11 %

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 2484 - MEDICAL WAREHOUSE

**Existing.** Building 2484 is not currently connected to the existing EMCS. Steam unit heaters heat the warehouse area. AHU's with a DX coil and steam coil heat and cool each office area.

**Proposed.** The warehouse area of Building 2484 is heated by steam unit heaters and the offices are heated and cooled by packaged AC units with steam coils. Steam is supplied from Building 2482. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2A for building envelope and equipment. Table 2484-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	RCU	Remarks
AC-1	2	1	3	2	8		O.A. damper control not included due to small unit size
AC-2	2	1	3	2	8		O.A. damper control not included due to small unit size
Unit Heaters	1		1	1	3		
Lighting				2	2		
						UPC	
TOTALS	5	2	7	7	21	1	

**TABLE 2484-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS			
	A/C-1	A/C-2	Unit Heaters	
Scheduled Start/Stop				
Optimum Start/Stop				
Duty Cycling				
Demand Limiting				
Day/Night Setback	X	X	X	
Economizer (Dry Bulb)	X	X		
Ventilation and Recirculation	X	X		
Hot Deck/Cold Deck Temp. Reset				
Steam Boiler Selection				
Hot Water Boiler Selection				
Hot Water Outside Air Reset				
Chiller Selection				
Chilled Water Temp. Reset				
Chiller Demand Limiting				
Lighting Control				

## Construction

### Cost.

The estimated cost to install the UMCS control points in Building 2484 is **\$21,610**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$19,380
SIOH	\$ 1,070
Design	<u>\$ 1,160</u>
TOTAL	\$21,610

### Savings.

The total anticipated savings by applying the before mentioned UMCS strategies is **\$3,910**. Refer to Attachment 8.2A for ESA program output. Table 2484-2 shows the individual strategy savings.

This building is heated by steam, which is supplied by the Boiler Plant, Building 2482. The heating savings shown are based on boiler fuel oil savings and an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses to and from the building. The heating fuel savings are in oil since the boilers are oil-fired only.

### Economics.

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### LCCID Inputs

Electric Energy Saved	=	213.9 mmBtu (62,672 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$2,010 ÷ 213.9 mmBtu)
Oil Energy Saved	=	350.8 mmBtu (2,529 gal x 138,700 Btu/gal ÷ 1,000,000 Btu/mmBtu)

$$\begin{aligned} \$/\text{mmBtu} - \text{Oil} &= \$4.6/\text{mmBtu} \\ &(\$1,570 \div 350.8 \text{ mmBtu}) \end{aligned}$$

$$\text{Construction \$} = \$19,380$$

$$\text{SIOH \$} = \$1,070$$

$$\text{Design \$} = \$1,160$$

$$\text{Maintenance \$} = \$330$$

Saving to Investment Ratio (SIR)	<b>1.59</b>
Simple Payback (Years)	<b>5.51</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2484 - MEDICAL WAREHOUSE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 2484-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	343.6		2,471	272		8	\$1,760
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	8.1		59			4	\$150
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	213.0			62,400			\$2,000
	0.0						\$0
<b>TOTALS</b>	<b>564.7</b>	<b>0</b>	<b>2,529</b>	<b>62,672</b>	<b>0</b>	<b>12</b>	<b>\$3,910</b>
		<b>\$0</b>	<b>\$1,570</b>	<b>\$2,010</b>	<b>\$0</b>	<b>\$330</b>	

Cost Savings Based on:

\$/mcf \$3.97  
 \$/Gal \$0.62  
 \$/kWh \$0.032  
 \$/kW \$96.28  
 \$/mh \$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 2484

ANALYSIS DATE: 07-25-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	19380.	
B. SIOH	\$	1070.	
C. DESIGN COST	\$	1160.	
D. TOTAL COST (1A+1B+1C)	\$	21610.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	21610.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	214.	\$ 2011.	8.18	\$ 16447.
B. DIST	\$ 4.50	351.	\$ 1579.	9.64	\$ 15218.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	0.	\$ 0.	9.51	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		565.	\$ 3589.		\$ 31665.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	330.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	2663.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 2663.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 3919.

5. SIMPLE PAYBACK PERIOD (1G/4) 5.51 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 34328.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 1.59  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 9.03 %

## **BUILDING BY BUILDING UMCS ANALYSIS**

### **BUILDING 2490 - LABORATORY**

**Existing.**

Building 2490 is not currently connected to the existing EMCS. Three AHU's condition the building with 100% outdoor air. Each unit has a CHW coil and a steam preheat and reheat coil. AHU-1 serves the first and second floors, AHU-2 serves the basement, and AHU -3, a multi-zone unit, serves the third floor. Two 135 ton centrifugal chillers with a single 270 ton cooling tower provides chilled water. Steam is provided by a central boiler plant in Building 2482.

**Proposed.**

Building 2490 is heated and cooled by air handling units. The DOE and ESA programs were used to calculate UMCS Annual Energy Savings.

Building 2490 is a laboratory building served by three air handling units and each unit is a 100% outdoor air unit. One unit serves the animal room and is a 24-hour per day, 365 day per year operation. No additional controls can be added here. AHU-1 serves the general laboratory space and AHU-2 provides fume hood makeup. The only energy saving strategy that can be applied is ventilation and recirculation control. In AHU-1 the outdoor air damper will be closed from 8 p.m. to 6 a.m., and in AHU-2 the outdoor air damper will be reduced from 100% to 25% from 8 p.m. to 6 a.m. day/night setback cannot be applied in order to maintain space conditions.

The DOE program was used to calculate ventilation and recirculation savings, while the ESA program was used to calculate chilled water reset and condenser water reset savings. Refer to Attachment 8.2A for building envelope and equipment. Table 2490-1 as follows indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.



**TABLE 2490-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS			
	AHU-1	AHU-2	Chiller	
Scheduled Start/Stop				
Optimum Start/Stop				
Duty Cycling				
Demand Limiting				
Day/Night Setback				
Economizer (Dry Bulb)				
Ventilation and Recirculation	X	X		
Reheat Coil Reset	X			
Steam Boiler Selection				
Hot Water Boiler Selection				
Hot Water Outside Air Reset				
Chiller Selection				
Chilled Water Temp. Reset			X	
Chiller Demand Limiting				
Lighting Control				
Condenser Water Temp. Reset			X	

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	4		1	1	6		
Water Cooled Chiller	12	2	3	5	22		
AHU-2	4		1	1	6		
Outdoor Air Temperature	2				2		
AHU-3	4		1	1	6		
Hot Water Pumps	1		2		3		
						SFP	
TOTALS	27	2	8	8	45	1	

**Construction Cost.**

The estimated cost to install the UMCS control points in Building 2490 is **\$58,450**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$52,420
SIOH	\$ 2,880
Design	<u>\$ 3,150</u>
TOTAL	\$58,450

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$24,000**. Refer to Attachment 8.2A for ESA program output. Table 2490-2 shows the individual strategy savings.

This building is heated by steam which is supplied by the Boiler Plant, Building 2482. The heating savings shown are based on boiler fuel oil savings and an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses to and from the building. The heating fuel savings are in oil since the boilers are oil-fired only.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	228.8 mmBtu (67,035 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$2,150 ÷ 228.8 mmBtu)
Oil Energy Saved	=	4,767.5 mmBtu (34,373 gal x 138,700 gal/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Oil	=	\$4.47/mmBtu (\$21,300 ÷ 4,767.5 mmBtu)
Construction \$	=	\$52,420
SIOH \$	=	\$2,880
Design \$	=	\$3,150
Maintenance \$	=	\$550

Saving to Investment Ratio (SIR)	<b>3.92</b>
Simple Payback (Years)	<b>2.42</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2490 - LABORATORY  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 2490-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	0.0						\$0
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	3,836.9		26,984	27,609		12	\$17,940
Reheat Coil Reset	1,112.2		7,389	25,594			\$5,400
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	38.2			11,181		4	\$470
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
Condenser Water Temp. Reset	9.0			2,651		4	\$190
<b>TOTALS</b>	<b>4,996.3</b>	<b>0</b>	<b>34,373</b>	<b>67,035</b>	<b>0</b>	<b>20</b>	<b>\$24,000</b>
		<b>\$0</b>	<b>\$21,300</b>	<b>\$2,150</b>	<b>\$0</b>	<b>\$550</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 2490

ANALYSIS DATE: 07-10-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	52420.		
B. SIOH	\$	2880.		
C. DESIGN COST	\$	3150.		
D. TOTAL COST (1A+1B+1C)	\$	58450.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)			\$	58450.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	229.	\$ 2151.	8.18	\$ 17593.
B. DIST	\$ 4.50	4768.	\$ 21454.	9.64	\$ 206814.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	0.	\$ 0.	9.51	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		4996.	\$ 23604.		\$ 224407.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	550.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	4439.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 4439.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 24154.

5. SIMPLE PAYBACK PERIOD (1G/4) 2.42 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 228846.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  3.92  
 (IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 19.32 %

## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 2501 - ADMINISTRATION

**Existing.** In Building 2501, there are three (3) points currently connected to the existing EMCS, one (1) temperature monitoring (space temperature) and two (2) start/stop points (furnace 1 & 2). These points are monitoring only points. Two gas fired furnaces heat the building. Cooling only AHU's cool the office areas with a DX coil and outdoor condensing unit.

**Proposed.** Building 2501 is heated and cooled by gas-fired furnaces and split system DX cooling units. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2B for building envelope and equipment. Table 2501-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
AC-1	4	2	3	2	11		No outdoor air to unit
AC-2	4	2	3	2	11		No outdoor air to unit
AC-3	4	2	3	2	11		No outdoor air to unit
AC-4	4	2	3	2	11		No outdoor air to unit
Furnace 1	2		1	1	4		No outdoor air to unit
Furnace 2	2		1	1	4		No outdoor air to unit
Lighting				3	3		
						SFP	
<b>TOTALS</b>	<b>20</b>	<b>8</b>	<b>14</b>	<b>13</b>	<b>55</b>	<b>1</b>	

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2501 - ADMINISTRATIVE  
UMCS STRATEGIES  
TABLE 2501-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS						
	AC-1	AC-2	AC-3	AC-4	Furnace-1	Furnace-2	Lighting
Scheduled Start/Stop	X	X	X	X			
Optimum Start/Stop	X	X	X	X			
Duty Cycling	X	X	X	X			
Demand Limiting	X	X	X	X			
Day/Night Setback					X	X	
Economizer (Dry Bulb)							
Ventilation and Recirculation							
Hot Deck/Cold Deck Temp. Reset							
Steam Boiler Selection							
Hot Water Boiler Selection							
Hot Water Outside Air Reset							
Chiller Selection							
Chilled Water Temp. Reset							
Chiller Demand Limiting							X
Lighting Control							

**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 2501 is **\$35,840**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$32,140
SIOH	\$ 1,770
Design	<u>\$ 1,930</u>
TOTAL	\$35,840

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$2,270**. Refer to Attachment 8.2B for ESA program output. Table 2501-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

LCCID Inputs

Electric Energy Saved	=	142.4 mmBtu (41,715 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.30/mmBtu (\$1,330 ÷ 142.4 mmBtu)
Yearly Electric Demand Saved	=	0.4 kW
Gas Energy Saved	=	58.7 mmBtu (56.9 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$230 ÷ 58.7 mmBtu)
Construction \$	=	\$32,140



SIOH \$ = \$1,770

Design \$ = \$1,930

Maintenance \$ = \$660 & \$370

Saving to Investment Ratio (SIR)	<b>0.61</b>
Simple Payback (Years)	<b>13.54</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2501 - ADMINISTRATIVE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 2501-2**

UMCS Strategy	Energy Savings Summary						Cost Savings
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	
Scheduled Start/Stop	7.4			2,181			\$70
Optimum Start/Stop	0.0						\$0
Duty Cycling	7.1			2,094			\$70
Demand Limiting	0.0				0.4		\$40
Day/Night Setback	58.7	56.9				12	\$560
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0					12	\$330
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	127.8			37,440			\$1,200
	0.0						\$0
TOTALS	201.0	56.9	0	41,715	0.4	24	\$2,270

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 2501

ANALYSIS DATE: 07-25-96      ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	32140.		
B. SIOH	\$	1610.		
C. DESIGN COST	\$	1930.		
D. TOTAL COST (1A+1B+1C)	\$	35680.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		35680.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	142.	\$ 1339.	8.18	\$ 10949.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	59.	\$ 226.	9.51	\$ 2149.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 40.	8.07	\$ 323.
N. TOTAL		201.	\$ 1605.		\$ 13421.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	1030.
(1) DISCOUNT FACTOR (TABLE A)	8.07		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	8312.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 8312.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 2635.

5. SIMPLE PAYBACK PERIOD (1G/4) 13.54 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 21734.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = .61  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 2786 - COMMISSARY

**Existing.** Building 2786 is not currently connected to the existing EMCS. AHU's with hot water heat and DX cooling serve the retail, office, and warehouse areas. There is a rooftop DX condensing unit for each AHU. Gas hot water boiler provides hot water. Two-pipe ceiling unit ventilators above the cashier area are for heating only.

**Proposed.** Building 2786 is heated and cooled by packaged air handling units and the EZDOE program was used to calculate UMCS Annual Energy Savings. The ESA program was used to calculate the boiler hot water reset savings. Refer to Attachment 8.2B for building envelope and equipment. Table 2786-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	4	2	4	3	13		
AHU-2	6		1	2	9		
AHU-3	3	2	2	1	8		
Hot Water Boiler	8	1	1	2	12		
						SFP	
<b>TOTALS</b>	<b>21</b>	<b>5</b>	<b>8</b>	<b>8</b>	<b>42</b>	<b>1</b>	

**TABLE 2786-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	AHU-1	AHU-2	AHU-3	Boiler	
Scheduled Start/Stop					
Optimum Start/Stop					
Duty Cycling					
Demand Limiting					
Day/Night Setback	X	X	X		
Economizer (Dry Bulb)	X	X			
Ventilation and Recirculation	X	X	X		
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset				X	
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting					
Lighting Control					

**Construction****Cost.**

The estimated cost to install the UMCS control points in Building 2786 is **\$48,100**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$43,140
SIOH	\$ 2,370
Design	<u>\$ 2,590</u>
TOTAL	\$48,100

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$10,670**. Refer to Attachment 8.2B for ESA program output. Table 2786-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	628.9 mmBtu (184,264 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$5,900 ÷ 628.9 mmBtu)
Gas Energy Saved	=	1,127.5 mmBtu (1,093.6 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$4,340 ÷ 1,127.5 mmBtu)
Construction \$	=	\$43,140
SIOH \$	=	\$2,370

Design \$ = \$2,590

Maintenance \$ = \$440

Saving to Investment Ratio (SIR)	1.94
Simple Payback (Years)	4.5

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2786 - COMMISSARY  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 2786-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	722.5	117.9		176,083		4	\$6,210
Economizer (Dry Bulb)	7.9	0.3		2,236		4	\$180
Ventilation and Recirculation	735.3	693.5		5,945		4	\$3,050
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	290.6	281.9				4	\$1,230
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
<b>TOTALS</b>	<b>1,756.4</b>	<b>1,093.6</b>	<b>0</b>	<b>184,264</b>	<b>0</b>	<b>16</b>	<b>\$10,670</b>

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50



LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 2786

ANALYSIS DATE: 07-11-96      ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	43140.	
B. SIOH	\$	2370.	
C. DESIGN COST	\$	2590.	
D. TOTAL COST (1A+1B+1C)	\$	48100.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		48100.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	629.	\$ 5912.	8.18	\$ 48357.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	1128.	\$ 4341.	9.51	\$ 41282.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		1756.	\$ 10253.		\$ 89639.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	440.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	3551.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 3551.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 10693.

5. SIMPLE PAYBACK PERIOD (1G/4) 4.50 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 93190.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 1.94  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 11.22 %

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 2789 - POST OFFICE

### Existing.

In Building 2789, there are eleven (11) points currently connected to the existing EMCS, six (6) temperature monitoring (space temperature, two supply air, two return air temperature, and hot water supply temperature) and five (5) start/stop points (AHU-1, AHU-2, two condensing unit, and boiler ). The only control of the five start/stop points is occupied/unoccupied scheduling control. Two AHU heat and cool the building with a hot water coil and DX coil. Condensing units are located on the roof. A gas fired hot water boiler provides hot water.

### Proposed.

Building 2789 is heated and cooled by two air handling units with hot water and DX coils and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2B for building envelope and equipment. Table 2789-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

### Point List.

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991.

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	4	2	4	3	13		
AHU-2	4	2	4	3	13		
Hot Water Boiler	8	1	1	2	12		
Lighting				2	2		
						RTU	
TOTALS	16	5	9	10	40	1	

**TABLE 2789-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS			
	AHU-1	AHU-2	Hot Water Boiler	Lighting
Scheduled Start/Stop				
Optimum Start/Stop				
Duty Cycling				
Demand Limiting				
Day/Night Setback	X	X		
Economizer (Dry Bulb)	X	X		
Ventilation and Recirculation	X	X		
Hot Deck/Cold Deck Temp. Reset				
Steam Boiler Selection				
Hot Water Boiler Selection				
Hot Water Outside Air Reset			X	
Chiller Selection				
Chilled Water Temp. Reset				
Chiller Demand Limiting				
Lighting Control				X

**Construction****Cost.**

The estimated cost to install the UMCS control points in Building 2789 is **\$49,350**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$44,260
SIOH	\$ 2,430
Design	<u>\$ 2,660</u>
TOTAL	\$49,350

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$3,300**. Refer to Attachment 8.2B for ESA program output. Table 2789-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	248.9 mmBtu (72,938 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$2,330 ÷ 248.9 mmBtu)
Yearly Electric Demand Saved	=	0.3 kW
Gas Energy Saved	=	129.2 mmBtu (125.3 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$500 ÷ 129.2 mmBtu)
Construction \$	=	\$44,260

SIOH \$ = \$2,430

Design \$ = \$2,660

Maintenance \$ = \$440 & \$1,350

Saving to Investment Ratio (SIR)	<b>0.78</b>
Simple Payback (Years)	<b>10.60</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2789 - POST OFFICE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 2789-2**

UMCS Strategy	Energy Savings Summary					
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)
Scheduled Start/Stop	2.0			589		4
Optimum Start/Stop	0.0					
Duty Cycling	3.8			1,117		
Demand Limiting	0.0				0.3	
Day/Night Setback	70.7	66.9		512		4
Economizer (Dry Bulb)	0.0					
Ventilation and Recirculation	22.7	22.0				4
Hot Deck/Cold Deck Temp. Reset	0.0					
Steam Boiler Selection	0.0					
Hot Water Boiler Selection	0.0					
Hot Water Outside Air Reset	37.5	36.4				4
Chiller Selection	0.0					
Chilled Water Temp. Reset	0.0					
Chiller Demand Limiting	0.0					
Lighting Control	241.4			70,720		
	0.0					
<b>TOTALS</b>	<b>378.1</b>	<b>125.3</b>	<b>0</b>	<b>72,938</b>	<b>0.3</b>	<b>16</b>
		<b>\$500</b>	<b>\$0</b>	<b>\$2,330</b>	<b>\$30</b>	<b>\$440</b>
						<b>\$3,300</b>

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 2789

ANALYSIS DATE: 07-25-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	44260.	
B. SIOH	\$	2430.	
C. DESIGN COST	\$	2660.	
D. TOTAL COST (1A+1B+1C)	\$	49350.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		49350.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	249.	\$ 2340.	8.18	\$ 19138.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	129.	\$ 497.	9.51	\$ 4730.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 30.	8.07	\$ 242.
N. TOTAL		378.	\$ 2867.		\$ 24111.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	1790.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	14445.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 14445.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 4657.

5. SIMPLE PAYBACK PERIOD (1G/4) 10.60 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 38556.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = .78  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 2790 - POST EXCHANGE

### Existing.

In Building 2790, there are forty-two (42) points currently connected to the existing EMCS, twenty-one (21) temperature monitoring (3 space temperature and 18 air temperature sensors) and twenty-one (21) start/stop points (21 packaged AHUs). These points are monitoring only points. Eight rooftop packaged units heat and cool the main retail space. Nine rooftop packaged units heat and cool individual retail and office areas. Each packaged unit has DX cooling and gas heating.

### Proposed.

Building 2790 is heated and cooled by packaged rooftop air handling units with gas heat, and the EZ-DOE program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2B for building envelope and equipment. Table 2790-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

### Point List.

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Packaged Rooftop AC Units	75			25	100		All units are packaged roof top units. Only occupied/unoccupied control of the units can be obtained with the UMCS. This will create day/night setback control. Currently units operate in occupied 24 hours per day.
						SFP,RTU	
<b>TOTALS</b>	75	0	0	25	100	2	



**TABLE 2790-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS						
	Packaged AC Unit						
Scheduled Start/Stop							
Optimum Start/Stop							
Duty Cycling							
Demand Limiting							
Day/Night Setback	X						
Economizer (Dry Bulb)	X						
Ventilation and Recirculation	X						
Hot Deck/Cold Deck Temp. Reset							
Steam Boiler Selection							
Hot Water Boiler Selection							
Hot Water Outside Air Reset							
Chiller Selection							
Chilled Water Temp. Reset							
Chiller Demand Limiting							
Lighting Control							

**Construction****Cost.**

The estimated cost to install the UMCS control points in Building 2790 is **\$51,080**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$45,810
SIOH	\$ 2,520
Design Fee	<u>\$ 2,750</u>
TOTAL	\$51,080

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$21,640**. Refer to Attachment 8.2B for ESA program output. Table 2790-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	586.3 mmBtu (171,790 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$5,500 ÷ 586.3 mmBtu)
Gas Energy Saved	=	3,478.5 mmBtu (3,373.9 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$13,390 ÷ 3,478.5 mmBtu)
Construction \$	=	\$45,810
SIOH \$	=	\$2,520

Design \$ = \$2,750

Maintenance \$ = \$2,750 & \$5,160

Saving to Investment Ratio (SIR)	<b>4.63</b>
Simple Payback (Years)	<b>1.91</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2790 - POSTEXCHANGE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 2790-2**

UMCS Strategy	Energy Savings Summary						Cost Savings
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	2,523.5	1,921.9		158,810		50	\$14,090
Economizer (Dry Bulb)	1,278.4	1,197.4		12,848			\$5,160
Ventilation and Recirculation	262.9	254.6		132		50	\$2,390
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
TOTALS	4,064.8	3,373.9	0	171,790	0	100	\$21,640
		\$13,390	\$0	\$5,500	\$0	\$2,750	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 2790

ANALYSIS DATE: 07-11-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	45810.	
B. SIOH	\$	2520.	
C. DESIGN COST	\$	2750.	
D. TOTAL COST (1A+1B+1C)	\$	51080.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	51080.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	586.	\$ 5511.	8.18	\$ 45082.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	3479.	\$ 13392.	9.51	\$ 127360.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		4065.	\$ 18903.		\$ 172442.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$ 7910.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 63834.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 63834.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 26813.

5. SIMPLE PAYBACK PERIOD (1G/4) 1.91 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 236276.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 4.63  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 21.33 %

## **BUILDING BY BUILDING UMCS ANALYSIS**

### **BUILDING 2793 - GUEST HOUSING**

**Existing.**

Building 2793 is not currently connected to the existing EMCS. An electric package terminal unit for heating and cooling each room.

**Proposed.**

Building 2793 is used for guest housing and temporary housing of military personnel until their permanent housing is available. This building operates 24 hours per day, 365 days per year. It is heated and cooled by individual electric packaged terminal air conditioning (PTAC) units with electric heat. Room occupants control each unit separately. There are no UMCS control strategies that can be applied to this building because the PTAC units are not capable of accepting DDC control commands.

Refer to Attachment 8.2B for building envelope and equipment schedules.

**Discussion.**

This building is not recommended for inclusion under the new UMCS because no energy savings can be attained nor can the equipment be compatible with a DDC control system.

## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 2812 - ADMINISTRATIVE

**Existing.** In Building 2812, there are six (6) points currently connected to the existing EMCS, two (2) temperature monitoring (space temperature and 2nd floor return air temperature) and four (4) start/stop points (Hot air furnace fan, furnace, first floor condensing unit, and second floor condensing unit). The only control is occupied/unoccupied scheduling for the four start/stop points. A gas fired furnace to heat and cools the building with a separate DX coil and condensing unit for each floor.

**Proposed.** Building 2812 is heated by a hot air gas-fired furnace and cooled by two condensing units with DX coils (one per floor). Only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2B for building envelope and equipment schedules. Table 2812-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Hot Air Furnace	2		1	1	4		
Condensing unit 1st Floor	1		1	1	3		
Condensing unit 2nd Floor	1		1	1	3		
Lighting				2	2		
						RTU	
<b>TOTALS</b>	<b>4</b>	<b>0</b>	<b>3</b>	<b>5</b>	<b>12</b>	<b>1</b>	

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 2812 - ADMINISTRATIVE  
UMCS STRATEGIES  
TABLE 2812-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	Hot Air Furnace	Condensing Unit 1st Flr	Condensing Unit 2nd Flr	Lighting	
Scheduled Start/Stop		X	X		
Optimum Start/Stop		X	X		
Duty Cycling					
Demand Limiting					
Day/Night Setback	X				
Economizer (Dry Bulb)					
Ventilation and Recirculation					
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset					
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting				X	
Lighting Control					



## Construction

### Cost.

The estimated cost to install the UMCS control points in Building 2812 is **\$17,030**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$15,270
SIOH	\$ 840
Design	<u>\$ 920</u>
TOTAL	\$17,030

### Savings.

The total anticipated savings by applying the before mentioned UMCS strategies is **\$820**. Refer to Attachment 8.2B for ESA program output. Table 2812-2 shows the individual strategy savings.

### Economics.

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### LCCID Inputs

Electric Energy Saved	=	39.3 mmBtu (11,526 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$370 ÷ 39.3 mmBtu)
Gas Energy Saved	=	58.6 mmBtu (56.8 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$230 ÷ 58.6 mmBtu)
Construction \$	=	\$15,270
SIOH \$	=	\$840

Design \$ = \$920

Maintenance \$ = \$220 & \$250

Saving to Investment Ratio (SIR)	<b>0.53</b>
Simple Payback (Years)	<b>15.99</b>

**Discussion.**

The SIR is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

# TABLE 2812-2

Cost Savings Based on:	\$/mcf	\$/Gal	\$/kWh	\$/kW	\$/mh
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LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 2812

ANALYSIS DATE: 07-25-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	15270.		
B. SIOH	\$	840.		
C. DESIGN COST	\$	920.		
D. TOTAL COST (1A+1B+1C)	\$	17030.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		17030.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	39.	\$ 369.	8.18	\$ 3022.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	59.	\$ 226.	9.51	\$ 2146.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		98.	\$ 595.		\$ 5167.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	470.
(1) DISCOUNT FACTOR (TABLE A)	8.07		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	3793.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTOR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 3793.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 1065.

5. SIMPLE PAYBACK PERIOD (1G/4) 15.99 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 8960.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .53$   
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 3000 - FE FACILITY

**Existing.** Building 3000 is not currently connected to the existing EMCS. Single AHU heats and cools the building with steam coils and a DX coil. A 50 ton DX chiller and gas fired steam boiler provide heating and cooling.

**Proposed.** Building 3000 is heated and cooled by a single air handling unit and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2B for building envelope and equipment. Table 3000-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	4		1	2	7		
DX Chiller	1		1	1	3		
Outdoor Air Temperature	2				2		
						SFP	
TOTALS	7	0	2	3	12	1	

**TABLE 3000-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS						
	AHU-1	DX Chiller					
Scheduled Start/Stop		X					
Optimum Start/Stop		X					
Duty Cycling		X					
Demand Limiting		X					
Day/Night Setback	X						
Economizer (Dry Bulb)	X						
Ventilation and Recirculation	X						
Hot Deck/Cold Deck Temp. Reset							
Steam Boiler Selection							
Hot Water Boiler Selection							
Hot Water Outside Air Reset							
Chiller Selection							
Chilled Water Temp. Reset							
Chiller Demand Limiting							
Lighting Control							

## Construction

### Cost.

The estimated cost to install the UMCS control points in Building 3000 is **\$12,500**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$11,210
SIOH	\$ 620
Design	<u>\$ 670</u>
TOTAL	\$12,500

### Savings.

The total anticipated savings by applying the before mentioned UMCS strategies is **\$2,380**. Refer to Attachment 8.2B for ESA program output. Table 3000-2 shows the individual strategy savings.

### Economics.

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### LCCID Inputs

Electric Energy Saved	=	19.6 mmBtu (5,732 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.20/mmBtu (\$180 ÷ 19.6 mmBtu)
Yearly Electric Demand Saved	=	1.5 kW
Gas Energy Saved	=	476.9 mmBtu (462.6 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$1,840 ÷ 476.9 mmBtu)
Construction \$	=	\$11,210

SIOH \$ = \$620

Design \$ = \$670

Maintenance \$ = \$220

Saving to Investment Ratio (SIR)	<b>1.75</b>
Simple Payback (Years)	<b>5.25</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.



**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 3000 - FE FACILITY  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 3000-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	15.1			4,415		4	\$250
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0				1.5		\$140
Day/Night Setback	417.7	400.8		1,317		4	\$1,740
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	63.7	61.8					\$250
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
	0.0						\$0
<b>TOTALS</b>	<b>496.5</b>	<b>462.6</b>	<b>0</b>	<b>5,732</b>	<b>1.5</b>	<b>8</b>	<b>\$2,380</b>
		<b>\$1,840</b>	<b>\$0</b>	<b>\$180</b>	<b>\$140</b>	<b>\$220</b>	

Cost Savings Based on:

\$/mcf \$3.97  
 \$/Gal \$0.62  
 \$/kWh \$0.032  
 \$/kW \$96.28  
 \$/mh \$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID    FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS.    3    CENSUS:    3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 3000

ANALYSIS DATE: 07-15-96    ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	11210.	
B. SIOH	\$	620.	
C. DESIGN COST	\$	670.	
D. TOTAL COST (1A+1B+1C)	\$	12500.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		12500.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	20.	\$ 184.	8.18	\$ 1507.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	477.	\$ 1836.	9.51	\$ 17461.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 140.	8.07	\$ 1130.
N. TOTAL		497.	\$ 2160.		\$ 20098.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		
(1) DISCOUNT FACTOR (TABLE A)	8.07	\$ 220.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 1775.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+) / COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) / COST(-) (3A2+3Bd4) \$ 1775.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 2380.

5. SIMPLE PAYBACK PERIOD (1G/4) 5.25 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 21873.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  1.75  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 10.09 %

## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 4215 - ADMINISTRATIVE

**Existing.** In Building 4215, there are ten (10) points currently connected to the existing EMCS, five (5) temperature monitoring (four (4) space temperature and dual temperature water supply and return temperature) and five (5) start/stop points (2 boilers, chiller, 2 pumps). The only control of the start/stop points is occupied/unoccupied scheduling control. Two-pipe fan coil units condition the building with a gas hot water boiler and a 125 ton air cooled chiller providing hot and chiller water.

**Proposed.** Building 4215 is heated and cooled by fan coil units and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2C for building envelope and equipment. Table 4215-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Fan Coil Units			2	2	4		
Hot Water Boilers	9	2	5	3	19		Dual temperature pumps included under fan coils
Air Cooled Chiller	7		4	4	15		
Lighting				4	4		
						SFP	
<b>TOTALS</b>	16	2	11	13	42	1	

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4215 - ADMINISTRATIVE  
UMCS STRATEGIES  
TABLE 4215-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	Fan Coils	Hot Water Boiler	Air Cooled Chiller	Lighting	
Scheduled Start/Stop			X		
Optimum Start/Stop			X		
Duty Cycling					
Demand Limiting					
Day/Night Setback	X				
Economizer (Dry Bulb)					
Ventilation and Recirculation					
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset		X			
Chiller Selection					
Chilled Water Temp. Reset			X		
Chiller Demand Limiting				X	
Lighting Control					

**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 4215 is **\$65,200**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$58,470
SIOH	\$ 3,220
Design	<u>\$ 3,510</u>
TOTAL	\$65,200

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$12,020**. Refer to Attachment 8.2C for ESA program output. Table 4215-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

LCCID Inputs

Electric Energy Saved	=	601.3 mmBtu (176,168 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$5,640 ÷ 601.3 mmBtu)
Gas Energy Saved	=	1,572.7 mmBtu (1,525.4 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$6,060 ÷ 1,572.7 mmBtu)
Construction \$	=	\$58,470
SIOH \$	=	\$3,220

Design \$ = \$3,510

Maintenance \$ = \$330 & \$1,230

Saving to Investment Ratio (SIR)	1.76
Simple Payback (Years)	4.98

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4215 - ADMINISTRATIVE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4215-2**

UMCS Strategy	Energy Savings Summary					
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)
Scheduled Start/Stop	10.0			2,943		
Optimum Start/Stop	0.0					
Duty Cycling	0.0					
Demand Limiting	0.0					
Day/Night Setback	1,229.9	1,184.2		2,645		4
Economizer (Dry Bulb)	0.0					
Ventilation and Recirculation	0.0					
Hot Deck/Cold Deck Temp. Reset	0.0					
Steam Boiler Selection	0.0					
Hot Water Boiler Selection	0.0					
Hot Water Outside Air Reset	351.8	341.2				4
Chiller Selection	0.0					
Chilled Water Temp. Reset	17.8			5,220		4
Chiller Demand Limiting	0.0					
Lighting Control	564.4			165,360		
	0.0					
<b>TOTALS</b>	<b>2,173.9</b>	<b>1,525.4</b>	<b>0</b>	<b>176,168</b>	<b>0</b>	<b>12</b>
		<b>\$6,060</b>	<b>\$0</b>	<b>\$5,640</b>	<b>\$0</b>	<b>\$330</b>

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 4215

ANALYSIS DATE: 07-25-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	58470.		
B. SIOH	\$	3220.		
C. DESIGN COST	\$	3510.		
D. TOTAL COST (1A+1B+1C)	\$	65200.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)			\$	65200.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	601.	\$ 5652.	8.18	\$ 46235.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	1528.	\$ 5882.	9.51	\$ 55934.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		2129.	\$ 11534.		\$ 102170.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		
(1) DISCOUNT FACTOR (TABLE A)	8.07	\$ 1560.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 12589.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 12589.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 13094.

5. SIMPLE PAYBACK PERIOD (1G/4) 4.98 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 114759.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  1.76  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 10.16 %



## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 4216 - ADMINISTRATIVE

**Existing.** In Building 4216, there are six (6) points currently connected to the existing EMCS, four (4) temperature monitoring (space temperature, hot water return and supply temperature and chilled water supply temperature) and two start/stop points (boiler and chiller). The only control of the two start/stop points is occupied/unoccupied scheduling control. Two pipe fan coil units condition the building with a gas hot water boiler and a 60 ton air cooled chiller providing the hot and chiller water.

**Proposed.** Building 4216 is heated and cooled by fan coil units and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2C for building envelope and equipment. Table 4216-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Fan Coil Units			2	2	4		
Hot Water Boiler	5	1	4	2	12		Dual temperature pumps included under fan coils
Air Cooled Chiller	6	1	4	4	15		
Lighting				4	4		
						RTU	
<b>TOTALS</b>	<b>11</b>	<b>2</b>	<b>10</b>	<b>12</b>	<b>35</b>	<b>1</b>	

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4216 - ADMINISTRATIVE  
UMCS STRATEGIES  
TABLE 4216-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS			
	Fan Coils	Hot Water Boiler	Air Cooled Chiller	Lighting
Scheduled Start/Stop			X	
Optimum Start/Stop			X	
Duty Cycling				
Demand Limiting				
Day/Night Setback	X			
Economizer (Dry Bulb)				
Ventilation and Recirculation				
Hot Deck/Cold Deck Temp. Reset				
Steam Boiler Selection				
Hot Water Boiler Selection				
Hot Water Outside Air Reset		X		
Chiller Selection				
Chilled Water Temp. Reset			X	
Chiller Demand Limiting				X
Lighting Control				

**Construction****Cost.**

The estimated cost to install the UMCS control points in Building 4216 is **\$52,630**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$47,200
SIOH	\$ 2,600
Design	<u>\$ 2,830</u>
TOTAL	\$52,630

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$5,250**. Refer to Attachment 8.2C for ESA program output. Table 4216-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	280.4 mmBtu (82,171 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$2,630 ÷ 280.4 mmBtu)
Gas Energy Saved	=	592.0 mmBtu (574.2 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$2,290 ÷ 592.0 mmBtu)
Construction \$	=	\$47,200
SIOH \$	=	\$2,600

Design \$ = \$2,830

Maintenance \$ = \$330 & \$730

Saving to Investment Ratio (SIR)	<b>0.98</b>
Simple Payback (Years)	<b>8.81</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4216 - ADMINISTRATIVE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4216-2**

UMCS Strategy	Energy Savings Summary					
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)
Scheduled Start/Stop	2.0			589		2
Optimum Start/Stop	0.0					
Duty Cycling	0.0					
Demand Limiting	0.0					
Day/Night Setback	438.1	421.4		1,076		4
Economizer (Dry Bulb)	0.0					
Ventilation and Recirculation	0.0					
Hot Deck/Cold Deck Temp. Reset	0.0					
Steam Boiler Selection	0.0					
Hot Water Boiler Selection	0.0					
Hot Water Outside Air Reset	157.5	152.8				4
Chiller Selection	0.0					
Chilled Water Temp. Reset	8.6			2,506		2
Chiller Demand Limiting	0.0					
Lighting Control	266.2			78,000		
	0.0					
<b>TOTALS</b>	<b>872.4</b>	<b>574.2</b>	<b>0</b>	<b>82,171</b>	<b>0</b>	<b>12</b>
		<b>\$2,290</b>	<b>\$0</b>	<b>\$2,630</b>	<b>\$0</b>	<b>\$330</b>

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      STUDY: MEADE  
 INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      LCCID FY95 (92)  
 PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY      CENSUS: 3  
 FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 4216  
 ANALYSIS DATE: 07-25-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	47200.	
B. SIOH	\$	2600.	
C. DESIGN COST	\$	2830.	
D. TOTAL COST (1A+1B+1C)	\$	52630.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	52630.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	280.	\$ 2636.	8.18	\$ 21561.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	592.	\$ 2279.	9.51	\$ 21675.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		872.	\$ 4915.		\$ 43236.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	1060.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	8554.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 8554.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 5975.

5. SIMPLE PAYBACK PERIOD (1G/4) 8.81 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 51790.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  .98  
 (IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 3.93 %

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 4217 - ADMINISTRATIVE

**Existing.**

In Building 4217, there are five (5) points currently connected to the existing EMCS, two (2) temperature monitoring (space temperature and dual temperature water supply temperature) and three (3) start/stop points (Chiller #1, Chiller #2, and Boiler). The only control of the three start/stop points is occupied/unoccupied scheduling control. Two pipe fan coil units condition the building with a gas hot water boiler and a 60 ton air cooled chiller providing hot and chiller water.

**Proposed.**

Building 4217 is heated and cooled by Fan Coil units and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2C for building envelope and equipment schedules. Table 4217-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991.

	AI	AO	DI	DO	Total	Panel	Remarks
Fan Coil Units			2	2	4		
Hot Water Boiler	9	2	5	3	19		Dual temperature pumps included under fan coils
Air Cooled Chiller	7		4	4	15		
Lighting				4	4		
						RTU	
TOTALS	16	2	11	13	42	1	

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4217 - ADMINISTRATIVE  
UMCS STRATEGIES  
TABLE 4217-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	Fan Coils	Hot Water Boiler	Air Cooled Chiller	Lighting	
Scheduled Start/Stop			X		
Optimum Start/Stop			X		
Duty Cycling					
Demand Limiting					
Day/Night Setback	X				
Economizer (Dry Bulb)					
Ventilation and Recirculation					
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset		X			
Chiller Selection					
Chilled Water Temp. Reset			X		
Chiller Demand Limiting				X	
Lighting Control					



**Construction****Cost.**

The estimated cost to install the UMCS control points in Building 4217 is **\$60,180**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$53,970
SIOH	\$ 2,970
Design	<u>\$ 3,240</u>
TOTAL	\$60,180

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$5,160**. Refer to Attachment 8.2C for ESA program output. Table 4217-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	267.1 mmBtu (78,263 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$2,500 ÷ 267.1 mmBtu)
Gas Energy Saved	=	632.6 mmBtu (613.6 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$2,440 ÷ 632.6 mmBtu)
Construction \$	=	\$53,970
SIOH \$	=	\$2,970

Design \$ = \$3,240

Maintenance \$ = \$220 & \$620

Saving to Investment Ratio (SIR)	<b>0.84</b>
Simple Payback (Years)	<b>10.40</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4217 - ADMINISTRATIVE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4217-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	3.3			981			\$30
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	421.2	404.1		1,354			\$1,650
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	216.0	209.5				4	\$940
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	7.1			2,088		4	\$180
Chiller Demand Limiting	0.0						\$0
Lighting Control	252.0			73,840			\$2,360
	0.0						\$0
<b>TOTALS</b>	<b>899.7</b>	<b>613.6</b>	<b>0</b>	<b>78,263</b>	<b>0</b>	<b>8</b>	<b>\$5,160</b>
		<b>\$2,440</b>	<b>\$0</b>	<b>\$2,500</b>	<b>\$0</b>	<b>\$220</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 4217

ANALYSIS DATE: 07-25-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	53970.	
B. SIOH	\$	2970.	
C. DESIGN COST	\$	3240.	
D. TOTAL COST (1A+1B+1C)	\$	60180.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	60180.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	267.	\$ 2511.	8.18	\$ 20538.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	633.	\$ 2436.	9.51	\$ 23162.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		900.	\$ 4946.		\$ 43700.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 840.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 6779.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 6779.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 5786.

5. SIMPLE PAYBACK PERIOD (1G/4) 10.40 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 50478.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .84$   
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 2.29 %

## **BUILDING BY BUILDING UMCS ANALYSIS**

### **BUILDING 4411 - ADMINISTRATIVE**

**Existing.**

In Building 4411, there are ten (10) points currently connected to the existing EMCS, three (3) temperature monitoring (space temperature, hot water supply temperature and chilled water supply temperature) and seven (7) start/stop points (2 boilers, 3 pumps, and 2 compressors). These points are monitoring points only. Five AHU's heat and cool the building. One per floor with two units in the basement. Each unit is a single zone unit with dual temp HW and CHW coil. The building is a two pipe system. Two pipe fan coil units serve the third floor porch areas. Two gas fired HW boilers and one 95 ton air cooled chiller provide hot and chilled water.

**Proposed.**

Building 4411 is heated and cooled by air handling units and the EZDOE program was used to calculate UMCS Annual Energy Savings. The ESA program was used to calculate demand savings, chiller savings, boiler hot water reset savings, and lighting savings. Refer to Attachment 8.2C for building envelope and equipment. Table 4411-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

**TABLE 4411-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS						
	AHU-1	AHU-2	AHU-3	AHU-4	AHU-5	Boiler	Chiller
Scheduled Start/Stop							X
Optimum Start/Stop							X
Duty Cycling							
Demand Limiting	X	X	X	X	X		
Day/Night Setback	X	X	X	X	X		
Economizer (Dry Bulb)	X	X	X	X	X		
Ventilation and Recirculation	X	X	X	X	X		
Hot Deck/Cold Deck Temp. Reset							
Steam Boiler Selection							
Hot Water Boiler Selection							
Hot Water Outside Air Reset						X	
Chiller Selection							
Chilled Water Temp. Reset							X
Chiller Demand Limiting							
Lighting Control							

	AI	AO	DI	DO	Total	Panel	Remarks
AHU's (5 total)	25	15	10	5	55		
Hot Water Boiler	5	1	4	2	12		
Air Cooled Chiller	7		4	4	15		
Lighting				4	4		
						SFP,RTU	
TOTALS	37	16	18	15	86	2	

**Construction Cost.**

The estimated cost to install the UMCS control points in Building 4411 is **\$90,570**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$81,230
SIOH	\$ 4,470
Design	\$ 4,870
TOTAL	\$90,570

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$25,790**. Refer to Attachment 8.2C for ESA program output. Table 4411-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

LCCID Inputs

$$\begin{aligned} \text{Electric Energy Saved} &= 1,626.8 \text{ mmBtu} \\ &= (476,660 \text{ kWh} \times 3,413 \text{ Btu/kWh} \div 1,000,000 \text{ Btu/mmBtu}) \end{aligned}$$

\$/mmBtu-Electric	=	\$9.40/mmBtu (\$15,250 ÷ 1,626.8 mmBtu)
Yearly Electric Demand Saved	=	3.4 kW
Gas Energy Saved	=	2,447.2 mmBtu (2,373.6 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$9,420 ÷ 2,447.2 mmBtu)
Construction \$	=	\$81,230
SIOH \$	=	\$4,470
Design \$	=	\$4,870
Maintenance \$	=	\$770 & \$1,230

Saving to Investment Ratio (SIR)	<b>2.58</b>
Simple Payback (Years)	<b>3.35</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.



**TABLE 4411-2**

Cost Savings Based on:	\$/mcf	\$3.97
	\$/Gal	\$0.62
	\$/kWh	\$0.032
	\$/kW	\$96.28
	\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 4411

ANALYSIS DATE: 07-25-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	81230.		
B. SIOH	\$	4470.		
C. DESIGN COST	\$	4870.		
D. TOTAL COST (1A+1B+1C)	\$	90570.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		\$	90570.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	1627.	\$ 15292.	8.18	\$ 125088.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	2447.	\$ 9422.	9.51	\$ 89601.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 330.	8.07	\$ 2663.
N. TOTAL		4074.	\$ 25044.		\$ 217352.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	2000.
(1) DISCOUNT FACTOR (TABLE A)	8.07		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	16140.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 16140.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 27044.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.35 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 233492.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 2.58  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 14.44 %

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 4418 - POST LIBRARY

### Existing.

In Building 4418, there are seven (7) points currently connected to the existing EMCS, four (4) temperature monitoring (space temperature, supply and return air temperature, and hot water supply temperature) and three (3) start/stop points (boiler, air handling unit and condensing unit). The only current control is occupied/unoccupied scheduling. A single AHU cools the building with a DX coil and a 15 ton air cooled condensing unit. Hot water fin tube radiation heats the building with hot water supplied from a oil fired boiler.

### Proposed.

Building 4418 is heated by perimeter hot water radiation and cooled by a single air handling unit with a DX coil and condensing unit, and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2C for building envelope and equipment. Table 4418-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

### Point List.

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991.

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	4	2	4	3	13		
Hot Water Boiler	8	1	1	2	12		
Lighting				2	2		
						UPC	
TOTALS	12	3	5	7	27	1	

## TABLE 4418-1

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	AHU-1	Hot Water Radiation	Lighting		
Scheduled Start/Stop	X				
Optimum Start/Stop	X				
Duty Cycling	X				
Demand Limiting	X				
Day/Night Setback	X	X			
Economizer (Dry Bulb)					
Ventilation and Recirculation					
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset					
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting					
Lighting Control			X		

**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 4418 is **\$36,430**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$32,670
SIOH	\$ 1,800
Design	<u>\$ 1,960</u>
TOTAL	\$36,430

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$670**. Refer to Attachment 8.2C for ESA program output. Table 4418-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

LCCID Inputs

Electric Energy Saved	=	26.6 mmBtu (7,799 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$250 ÷ 26.6 mmBtu)
Gas Energy Saved	=	42.2 mmBtu (304 mcf x 138,700 Btu/gal ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$4.50/mmBtu (\$190 ÷ 42.2 mmBtu)
Construction \$	=	\$32,670
SIOH \$	=	\$1,800

Design \$ = \$1,960

Maintenance \$ = \$220 & \$860

Saving to Investment Ratio (SIR)	<b>0.34</b>
Simple Payback (Years)	<b>24.41</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4418 - LIBRARY  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4418-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	1.6			483			\$20
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.9			262			\$10
Demand Limiting	0.0						\$0
Day/Night Setback	43.2		304	294		8	\$420
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	23.1			6,760			\$220
	0.0						\$0
<b>TOTALS</b>	<b>68.8</b>	<b>0.0</b>	<b>304</b>	<b>7,799</b>	<b>0.0</b>	<b>8</b>	<b>\$670</b>
		<b>\$0</b>	<b>\$190</b>	<b>\$250</b>	<b>\$0</b>	<b>\$220</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 4418

ANALYSIS DATE: 07-25-96      ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	32670.	
B. SIOH	\$	1800.	
C. DESIGN COST	\$	1960.	
D. TOTAL COST (1A+1B+1C)	\$	36430.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		36430.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	27.	\$ 250.	8.18	\$ 2045.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	42.	\$ 162.	9.51	\$ 1545.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		69.	\$ 413.		\$ 3590.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	1080.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	8716.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 8716.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 1493.

5. SIMPLE PAYBACK PERIOD (1G/4) 24.41 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 12306.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .34$   
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A



## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 4419 - POST CHAPEL

**Existing.** In Building 4419, there are twenty-one (21) points currently connected to the existing EMCS, fourteen (14) temperature monitoring (one (1) space temperature, twelve (12) air temperature and one (1) steam supply temperature) and seven (7) start/stop points (Boiler, chiller, 4 AHU's, and chilled water pump). There is no operational occupied/unoccupied scheduling to this building. 5 AHU's heat and cool the building with steam heat and a 50 ton air cooled chiller.

**Proposed.** Building 4419 is heated and cooled by air handling units and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2C for building envelope and equipment. Table 4419-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	4	2	4	3	13		
AHU-2	4	2	4	3	13		
AHU-3	4	2	4	3	13		
AHU-4	2	1	3	2	8		
Air Cooled Chiller	6	1	3	2	12		
AHU-5	2	1	3	2	8		
						SFP,RTU	
TOTALS	22	9	21	15	67	2	

**TABLE 4419-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS					
	AHU-1	AHU-2	AHU-3	AHU-4	AHU-5	Air Cooled Chiller
Scheduled Start/Stop	X	X	X	X	X	X
Optimum Start/Stop	X	X	X	X	X	X
Duty Cycling						
Demand Limiting	X	X	X	X	X	
Day/Night Setback						
Economizer (Dry Bulb)	X	X	X	X	X	
Ventilation and Recirculation	X	X	X	X	X	
Hot Deck/Cold Deck Temp. Reset						
Steam Boiler Selection						
Hot Water Boiler Selection						
Hot Water Outside Air Reset						
Chiller Selection						
Chilled Water Temp. Reset						X
Chiller Demand Limiting						
Lighting Control						

**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 4419 is **\$47,970**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$43,020
SIOH	\$ 2,370
Design	<u>\$ 2,580</u>
TOTAL	\$47,970

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$4,430**. Refer to Attachment 8.2C for ESA program output. Table 4419-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved = 156.4 mmBtu  
(45,824 kWh x 3,413 Btu/kWh ÷  
1,000,000 Btu/mmBtu)

\$/mmBtu-Electric = \$9.40/mmBtu  
(\$1,470 ÷ 156.4 mmBtu)

Yearly Electric  
Demand Saved = 2.7 kW

Gas Energy Saved = 530.4 mmBtu  
(514.5 mcf x 1,031,000 Btu/mcf ÷  
1,000,000 Btu/mmBtu)

\$/mmBtu - Gas = \$3.80/mmBtu  
(\$2,040 ÷ 530.4 mmBtu)

Construction \$ = \$43,020

SIOH \$ = \$2,370

Design \$ = \$2,580

Maintenance \$ = \$660 & \$980

Saving to Investment Ratio (SIR)	<b>0.98</b>
Simple Payback (Years)	<b>8.86</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4419 - POST CHAPEL  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4419-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	630.9	469.2		43,110		10	\$3,520
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0				2.7		\$260
Day/Night Setback	0.0						\$0
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	46.7	45.3				10	\$450
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	9.3			2,714		4	\$200
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
							\$0
<b>TOTALS</b>	<b>686.8</b>	<b>514.5</b>	<b>0</b>	<b>45,824</b>	<b>2.7</b>	<b>24</b>	<b>\$4,430</b>
		<b>\$2,040</b>	<b>\$0</b>	<b>\$1,470</b>	<b>\$260</b>	<b>\$660</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY  
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) STUDY: MEADE  
 INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 LCCID FY95 (92)  
 PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY CENSUS: 3  
 FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 4419  
 ANALYSIS DATE: 07-15-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	43020.		
B. SIOH	\$	2370.		
C. DESIGN COST	\$	2580.		
D. TOTAL COST (1A+1B+1C)	\$	47970.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		47970.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	156.	\$ 1470.	8.18	\$ 12026.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	530.	\$ 2042.	9.51	\$ 19420.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 260.	8.07	\$ 2098.
N. TOTAL		687.	\$ 3772.		\$ 33544.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		
(1) DISCOUNT FACTOR (TABLE A)	8.07	\$ 1640.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 13235.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 13235.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 5412.

5. SIMPLE PAYBACK PERIOD (1G/4) 8.86 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 46779.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .98$   
 (IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 4431 - THEATER

**Existing.** In Building 4431, there are eight (8) points currently connected to the existing EMCS, five (5) temperature monitoring (space temperature AHU supply-return-mixed air temperatures, and steam supply temperature) and three (3) start/stop points (Air handling unit, chiller and boiler ). This building has be deleted from the existing EMCS. Single AHU heats and cools the building with gas steam heat and 30 tons of DX cooling.

**Proposed.** Building 4431 is heated and cooled by a single air handling unit with steam and DX coils and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2C for building envelope and equipment. Table 4431-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	4	2	4	3	13		
Air Cooled Condenser	1		1	1	3		
Lighting				2	2		
						RTU	
TOTALS	5	2	5	6	18	1	

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4431 - THEATER  
UMCS STRATEGIES  
TABLE 4431-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	AHU-1	Steam Boiler	Air Cooled Condenser	Air Cooled Condenser	Lighting
Scheduled Start/Stop			X	X	
Optimum Start/Stop			X	X	
Duty Cycling			X	X	
Demand Limiting			X	X	
Day/Night Setback	X				
Economizer (Dry Bulb)	X				
Ventilation and Recirculation	X				
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset					
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting					X
Lighting Control					



## Construction

### Cost.

The estimated cost to install the UMCS control points in Building 4431 is **\$24,590**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$22,060
SIOH	\$ 1,210
Design	<u>\$ 1,320</u>
TOTAL	\$24,590

### Savings.

The total anticipated savings by applying the before mentioned UMCS strategies is **\$1,570**. Refer to Attachment 8.2C for ESA program output. Table 4431-2 shows the individual strategy savings.

### Economics.

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### LCCID Inputs

Electric Energy Saved	=	64 mmBtu (18,751 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$600 ÷ 64 mmBtu)
Yearly Electric Demand Saved	=	0.7 kW
Gas Energy Saved	=	175.9 mmBtu (170.6 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$680 ÷ 175.9 mmBtu)
Construction \$	=	\$22,060

SIOH \$ = \$1,210

Design \$ = \$1,320

Maintenance \$ = \$220 & \$980

Saving to Investment Ratio (SIR)	<b>0.88</b>
Simple Payback (Years)	<b>9.65</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**TABLE 4431-2**

Cost Savings Based on:	\$/mcf	\$3.97
	\$/Gal	\$0.62
	\$/kWh	\$0.032
	\$/kW	\$96.28
	\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 4431

ANALYSIS DATE: 07-25-96      ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	22060.	
B. SIOH	\$	1210.	
C. DESIGN COST	\$	1320.	
D. TOTAL COST (1A+1B+1C)	\$	24590.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	24590.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	64.	\$ 602.	8.18	\$ 4921.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	176.	\$ 677.	9.51	\$ 6440.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 70.	8.07	\$ 565.
N. TOTAL		240.	\$ 1349.		\$ 11926.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	1200.
(1) DISCOUNT FACTOR (TABLE A)	8.07		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	9684.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 9684.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 2549.

5. SIMPLE PAYBACK PERIOD (1G/4) 9.65 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 21610.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .88$   
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

## **BUILDING BY BUILDING UMCS ANALYSIS**

### **BUILDING 4432 - ADMINISTRATION**

#### **Existing.**

In Building 4432, there are fourteen (14) points currently connected to the existing EMCS, eight (8) temperature monitoring (1 space temperature, 6 air temperatures, and 1 hot water temperature) and six (6) start/stop points (3 AHUs, 1 boiler, and 2 condenser units). The only control of these points by the existing zones is occupied/unoccupied scheduling. Two AHU's with DX cooling and HW heat and small split system unit with DX cooling and electric heat condition the building. HW fin tube radiation on perimeter. A gas fired hot water boiler provides hot water.

#### **Proposed.**

Building 4432 is heated and cooled by fin tube radiation and split-system air handling units. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2C for building envelope and equipment. Table 4432-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

#### **Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4432 - ADMINISTRATIVE  
UMCS STRATEGIES  
TABLE 4432-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS					
	AHU-1	AHU-2	AHU-3	AHU-4	Boiler	Fin Tube Radiation
Scheduled Start/Stop	X	X	X	X		
Optimum Start/Stop	X	X	X	X		
Duty Cycling						
Demand Limiting	X	X	X	X		
Day/Night Setback						X
Economizer (Dry Bulb)	X	X	X	X		
Ventilation and Recirculation	X	X	X	X		
Hot Deck/Cold Deck Temp. Reset						
Steam Boiler Selection						
Hot Water Boiler Selection						
Hot Water Outside Air Reset					X	
Chiller Selection						
Chilled Water Temp. Reset						
Chiller Demand Limiting						
Lighting Control						X

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	5		3	3	11		
AHU-2	5		3	3	11		
AHU-3	3			1	4		
AHU-4	5		3	3	11		
Hot Water Boiler	8	1	1	2	12		
Fin Tube Radiation & Pumps	1	1	1	1	4		
Lighting				2	2		
						SFP	
TOTALS	27	2	11	15	55	1	

**Construction Cost.**

The estimated cost to install the UMCS control points in Building 4432 is **\$63,400**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$56,860
SIOH	\$ 3,130
Design Fee	<u>\$ 3,410</u>
TOTAL	\$63,400

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$6,780**. Refer to Attachment 8.2C for ESA program output. Table 4432-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

### LCCID Inputs

Electric Energy Saved = 293.2 mmBtu  
(85,911 kWh x 3,413 Btu/kWh ÷  
1,000,000 Btu/mmBtu)

\$/mmBtu-Electric = \$9.40/mmBtu  
(\$2,750 ÷ 293.2 mmBtu)

Yearly Electric  
Demand Saved = 2.0 kW

Gas Energy Saved = 852.6 mmBtu  
(827 mcf x 1,031,000 Btu/mcf ÷  
1,000,000 Btu/mmBtu)

\$/mmBtu - Gas = \$3.80/mmBtu  
(\$3,280 ÷ 852.6 mmBtu)

Construction \$ = \$56,860

SIOH \$ = \$3,130

Design \$ = \$3,410

Maintenance \$ = \$550 & \$1,720

Saving to Investment Ratio (SIR)	1.16
Simple Payback (Years)	7.46

#### Discussion.

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.



**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4432 - ADMINISTRATIVE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4432-2**

UMCS Strategy	Energy Savings Summary						Cost Savings
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	
Scheduled Start/Stop	573.2	482.4		22,211		8	\$2,850
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0				2.0		\$190
Day/Night Setback	207.5	201.3				8	\$1,020
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	67.7	65.7					\$260
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	80.0	77.6				4	\$420
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	217.4			63,700			\$2,040
	0.0						\$0
<b>TOTALS</b>	<b>1,145.9</b>	<b>827.0</b>	<b>0</b>	<b>85,911</b>	<b>2.0</b>	<b>20</b>	<b>\$6,780</b>
		<b>\$3,280</b>	<b>\$0</b>	<b>\$2,750</b>	<b>\$190</b>	<b>\$550</b>	

Cost Savings Based on:

\$/mcf \$3.97  
 \$/Gal \$0.62  
 \$/kWh \$0.032  
 \$/kW \$96.28  
 \$/mh \$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID    FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS.    3    CENSUS:    3

PROJECT NO. & TITLE: 4130.07    UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 4432

ANALYSIS DATE:    07-25-96    ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	56860.		
B. SIOH	\$	3130.		
C. DESIGN COST	\$	3410.		
D. TOTAL COST (1A+1B+1C)	\$	63400.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		63400.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	293.	\$ 2756.	8.18	\$ 22545.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	853.	\$ 3283.	9.51	\$ 31217.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 190.	8.07	\$ 1533.
N. TOTAL		1146.	\$ 6229.		\$ 55295.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	2270.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	18319.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 18319.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 8499.

5. SIMPLE PAYBACK PERIOD (1G/4) 7.46 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 73614.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 1.16  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 5.67 %

## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 4471 - CREDIT UNION

**Existing.** In Building 4471, there are eight (8) points currently connected to the existing EMCS, four (4) temperature monitoring (space temperature and 3 air temperatures) and four (4) start/stop points (furnace, condensing unit and AHU (deleted)). These points are monitoring only points. An oil fired hot air furnace heats in winter and cools in summer with two DX air cooled condensers.

**Proposed.** Building 4471 is heated and cooled by an oil fired furnace and condensing units and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2C for building envelope and equipment. Table 4471-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Oil Fired Furnace	1		1	1	3		
Condensing Units (2 total)	2		2	2	6		
						UPC	
<b>TOTALS</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>9</b>	<b>1</b>	

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4471 - CREDIT UNION  
UMCS STRATEGIES  
TABLE 4471-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	Oil Fired Furnace	Cond. Unit			
Scheduled Start/Stop		X			
Optimum Start/Stop		X			
Duty Cycling		X			
Demand Limiting		X			
Day/Night Setback	X				
Economizer (Dry Bulb)					
Ventilation and Recirculation					
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset					
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting					
Lighting Control					

**Construction****Cost.**

The estimated cost to install the UMCS control points in Building 4471 is **\$4,840**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$4,340
SIOH	\$ 240
Design	<u>\$ 260</u>
TOTAL	\$4,840

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$890**. Refer to Attachment 8.2C for ESA program output. Table 4471-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	29.3 mmBtu (8,580 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.20/mmBtu (\$270 ÷ 29.3 mmBtu)
Yearly Electric Demand Saved	=	1.5 kW
Oil Energy Saved	=	58.1 mmBtu (419 gal x 138,700 Btu/gal ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Oil	=	\$4.50/mmBtu (\$260 ÷ 58.1 mmBtu)
Construction \$	=	\$4,340

SIOH \$ = \$240

Design \$ = \$260

Maintenance \$ = \$220 & \$980

Saving to Investment Ratio (SIR)	3.22
Simple Payback (Years)	2.58

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4471 - CREDIT UNION  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4471-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	13.4			3,925		4	\$240
Optimum Start/Stop	0.0						\$0
Duty Cycling	15.9			4,655			\$150
Demand Limiting	0.0				1.5		\$140
Day/Night Setback	58.1		419			4	\$360
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
	0.0						\$0
<b>TOTALS</b>	<b>87.4</b>	<b>0</b>	<b>419</b>	<b>8,580</b>	<b>1.5</b>	<b>8</b>	<b>\$890</b>
		<b>\$0</b>	<b>\$260</b>	<b>\$270</b>	<b>\$140</b>	<b>\$220</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 4471

ANALYSIS DATE: 07-15-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	4340.	
B. SIOH	\$	240.	
C. DESIGN COST	\$	260.	
D. TOTAL COST (1A+1B+1C)	\$	4840.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		4840.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	29.	\$ 275.	8.18	\$ 2253.
B. DIST	\$ 4.50	58.	\$ 261.	9.64	\$ 2520.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	0.	\$ 0.	9.51	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 140.	8.07	\$ 1130.
N. TOTAL		87.	\$ 677.		\$ 5903.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	1200.
(1) DISCOUNT FACTOR (TABLE A)	8.07		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	9684.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 9684.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 1877.

5. SIMPLE PAYBACK PERIOD (1G/4) 2.58 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 15587.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  3.22  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 17.02 %



## **BUILDING BY BUILDING UMCS ANALYSIS**

### **BUILDING 4550 - ADMINISTRATIVE**

#### **Existing.**

In Building 4550, there are forty-four (44) points currently connected to the existing EMCS, twenty-eight (28) temperature monitoring points ((1) space temperature, (24) air temperature and (3) water temperature), one damper status point, and fifteen (15) start/stop points ((9) AHU, (2) boiler, (1) chiller, (2) pump, and (1) H & V unit). The building has an Andover DDC control system which was recently installed. The existing points above are monitoring and proof-of-run points only. There are two multi-zone AHU's per floor, except the fourth floor, which has a single unit. Each unit has a hot water hot deck and a chilled water cold deck coil. Two gas fired hot water boilers and two air cooled chillers on fourth floor provide hot and chilled water.

#### **Proposed.**

Building 4550 is heated and cooled by multi-zone air handling units and the DOE program was used to calculate UMCS Annual Energy Savings. The ESA program was used to calculate demand savings, boiler savings and chiller savings. Refer to Attachment 8.2D for building envelope and equipment. Table 4550-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

#### **Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4550 - ADMINISTRATIVE  
UMCS STRATEGIES  
TABLE 4550-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS					
	Multizone AHU's	Single Zone AHU's	H&V-1	Boilers	Chillers	Lighting
Scheduled Start/Stop			X		X	
Optimum Start/Stop			X		X	
Duty Cycling						
Demand Limiting	X	X				
Day/Night Setback	X	X				
Economizer (Dry Bulb)	X	X				
Ventilation and Recirculation	X	X				
Hot Deck/Cold Deck Temp. Reset	X					
Steam Boiler Selection						
Hot Water Boiler Selection						
Hot Water Outside Air Reset				X		
Chiller Selection					X	
Chilled Water Temp. Reset					X	
Chiller Demand Limiting						
Lighting Control						X

	AI	AO	DI	DO	Total	Panel	Remarks
Multi-zone AHU's	48	16	8	16	88		
Single Zone AHU	5	3	2	1	11		
Hot Water Boiler	14	2	2	4	22		
Heat & Vent Unit	3	2	2	1	8		
Air Cooled Chiller	6	2	6	4	18		
Lighting				4	4		
						SFP, RTU (3)	
TOTALS	76	25	20	30	151	4	

**Construction Cost.**

The estimated cost to install the UMCS control points in Building 4550 is **\$167,610**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$150,320
SIOH	\$ 8,270
Design	<u>\$ 9,020</u>
TOTAL	\$167,610

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$46,490**. Refer to Attachment 8.2D for DOE program output. Table 4550-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

## LCCID Inputs

Electric Energy Saved	=	1,616.8 mmBtu (473,710 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$15,160 ÷ 1,616.8 mmBtu)
Yearly Electric Demand Saved	=	19.8 kW
Gas Energy Saved	=	7,356.1 mmBtu (7,134.9 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$28,330 ÷ 7,356.1 mmBtu)
Construction \$	=	\$150,320
SIOH \$	=	\$8,270
Design \$	=	\$9,020
Maintenance \$	=	\$1,100 & \$5,410

Saving to Investment Ratio (SIR)	<b>2.75</b>
Simple Payback (Years)	<b>3.23</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4550 - ADMINISTRATIVE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4550-2**

UMCS Strategy	Energy Savings Summary					
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)
Scheduled Start/Stop	583.3	387.0		53,997		
Optimum Start/Stop	0.0					
Duty Cycling	0.0					
Demand Limiting	0.0				19.8	
Day/Night Setback	7,541.0	6,454.8		259,616		32
Economizer (Dry Bulb)	0.0					
Ventilation and Recirculation	112.0	98.5		3,047		4
Hot Deck/Cold Deck Temp. Reset	66.4	46.7		5,335		4
Steam Boiler Selection	0.0					
Hot Water Boiler Selection	0.0					
Hot Water Outside Air Reset	152.5	147.9				
Chiller Selection	5.7			1,670		
Chilled Water Temp. Reset	68.4			20,045		
Chiller Demand Limiting	0.0					
Lighting Control	443.7			130,000		
	0.0					
<b>TOTALS</b>	<b>8,972.9</b>	<b>7,134.9</b>	<b>0</b>	<b>473,710</b>	<b>19.8</b>	<b>40</b>
		<b>\$28,330</b>	<b>\$0</b>	<b>\$15,160</b>	<b>\$1,910</b>	<b>\$1,100</b>

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      STUDY: MEADE  
 INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      LCCID FY95 (92)  
 PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY      CENSUS: 3  
 FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 4550  
 ANALYSIS DATE: 07-25-96      ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	150320.	
B. SIOH	\$	8270.	
C. DESIGN COST	\$	9020.	
D. TOTAL COST (1A+1B+1C)	\$	167610.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	167610.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	1617.	\$ 15198.	8.18	\$ 124319.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	7356.	\$ 28321.	9.51	\$ 269333.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 1910.	8.07	\$ 15414.
N. TOTAL		8973.	\$ 45429.		\$ 409065.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 6510.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 52536.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 52536.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 51939.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.23 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 461601.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  2.75  
 (IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 15.20 %

## **BUILDING BY BUILDING UMCS ANALYSIS**

### **BUILDING 4551 - ADMINISTRATIVE**

#### **Existing.**

In Building 4551, there are nineteen (19) points currently connected to the existing EMCS, twelve (12) temperature monitoring (one space temperature, three supply air temperatures, four return air temperatures, three mixed air temperatures, and hot water supply temperature) and seven (7) start/stop points (chiller, boiler, chilled water pump, AHU-1, AHU-2, AHU-3, and AHU-4). The only control of the seven start/stop points is occupied/unoccupied scheduling control. Two multi-zone units serve the center of the first floor and one multi-zone unit serves the center of the second floor. Each multi-zone unit has a dual temp coil. A small split system heat pump supplies the conference room. Two pipe fan coil units condition each end of each floor of the building. A gas fired hot water boiler and 50 ton air cooled chiller provide hot and chilled water.

#### **Proposed.**

Building 4551 is heated and cooled by multi-zone air handling units and fan coils. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2D for building envelope and equipment. Table 4551-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

#### **Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. The point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4551 - ADMINISTRATIVE  
UMCS STRATEGIES  
TABLE 4551-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS							
	AHU-1	AHU-2	AHU-4	Hot Water Boiler	AHU-3	Fan Coils	Air Cooled Chiller	Lighting
Scheduled Start/Stop							X	
Optimum Start/Stop							X	
Duty Cycling								
Demand Limiting	X	X	X		X			
Day/Night Setback	X	X	X		X	X		
Economizer (Dry Bulb)	X	X	X		X			
Ventilation and Recirculation	X	X	X		X			
Hot Deck/Cold Deck Temp. Reset	X	X	X					
Steam Boiler Selection								
Hot Water Boiler Selection								
Hot Water Outside Air Reset				X				
Chiller Selection								
Chilled Water Temp. Reset							X	
Chiller Demand Limiting								X
Lighting Control								



	AI	AO	DI	DO	Total	Panel	Remarks
Hot Water Boiler	5	1	4	2	12		
Air Cooled Chiller	7		4	4	15		
AHU-1	6	2	1	2	11		
AHU-2	6	2	1	2	11		
AHU-3	4	2	3	3	12		
AHU-4	6	2	1	2	11		
Lighting				3	3		
						SFP,RTU	
TOTALS	34	9	14	18	75	2	

**Construction Cost.**

The estimated cost to install the UMCS control points in Building 4551 is **\$73,720**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$66,110
SIOH	\$ 3,640
Design	<u>\$ 3,970</u>
TOTAL	\$73,720

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$5,010**. Refer to Attachment 8.2D for ESA program output. Table 4551-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

### LCCID Inputs

Electric Energy Saved	=	150.1 mmBtu (43,965 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.30/mmBtu (\$1,410 ÷ 150.1 mmBtu)
Yearly Electric Demand Saved	=	0.8 kW
Gas Energy Saved	=	715.4 mmBtu (693.9 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$2,750 ÷ 715.4 mmBtu)
Construction \$	=	\$66,110
SIOH \$	=	\$3,640
Design \$	=	\$3,970
Maintenance \$	=	\$770 & \$1,110

Saving to Investment Ratio (SIR)	<b>0.73</b>
Simple Payback (Years)	<b>12.04</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4551 - ADMINISTRATIVE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4551-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	1.3			392			\$10
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0				0.8		\$80
Day/Night Setback	373.1	358.7		961		16	\$1,890
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	27.6	26.8					\$110
Hot Deck/Cold Deck Temp. Reset	73.9	61.5		3,084		4	\$450
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	254.6	246.9				4	\$1,090
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	7.1			2,088		4	\$180
Chiller Demand Limiting	0.0						\$0
Lighting Control	127.8			37,440			\$1,200
	0.0						\$0
<b>TOTALS</b>	<b>865.5</b>	<b>693.9</b>	<b>0</b>	<b>43,965</b>	<b>0.8</b>	<b>28</b>	<b>\$5,010</b>
		<b>\$2,750</b>	<b>\$0</b>	<b>\$1,410</b>	<b>\$80</b>	<b>\$770</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 4551

ANALYSIS DATE: 07-25-96      ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	66110.		
B. SIOH	\$	3640.		
C. DESIGN COST	\$	3970.		
D. TOTAL COST (1A+1B+1C)	\$	73720.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		73720.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	150.	\$ 1411.	8.18	\$ 11541.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	715.	\$ 2754.	9.51	\$ 26193.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 80.	8.07	\$ 646.
N. TOTAL		866.	\$ 4245.		\$ 38380.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	1880.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	15172.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 15172.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 6125.

5. SIMPLE PAYBACK PERIOD (1G/4) 12.04 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 53552.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .73$   
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

## **BUILDING BY BUILDING UMCS ANALYSIS**

### **BUILDING 4552 - ADMINISTRATIVE**

#### **Existing.**

In Building 4552, there are thirty-six (36) points currently connected to the existing EMCS, twenty (20) temperature monitoring (16 duct air temperature, chilled water supply and return temperature, and steam supply temperature) and sixteen (16) start/stop points (2 boiler, 5 condensing units, 6 AHU's, 1 outdoor air damper and 2 chillers). The building also has a Barber Coleman DDC control system which only controls units and has no scheduling. The existing EMCS is inoperable to Building 4552. Seven AHU's heat and cool the building. Five of the units are packaged units with DX cooling and steam coils with three units being multi-zone and two units single zone. A outdoor condensing unit exists for each packaged unit. The additional two units are single zone AHU's with chilled water coils and steam coils. Two 30 ton air cooled chillers serve these two units. Two gas fired steam boilers in the basement serve the entire building.

#### **Proposed.**

Building 4552 is heated and cooled by packaged air handling units and the DOE program was used to calculate UMCS Annual Energy Savings. The ESA program was used to calculate demand savings, lighting savings, and hot/cold deck temperature reset savings. Refer to Attachment 8.2D for building envelope and equipment. Table 4552-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

#### **Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

**TABLE 4552-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	Multizone AHU's	Single Zone AHU's	Lighting		
Scheduled Start/Stop					
Optimum Start/Stop					
Duty Cycling					
Demand Limiting	X	X			
Day/Night Setback	X	X			
Economizer (Dry Bulb)	X	X			
Ventilation and Recirculation	X	X			
Hot Deck/Cold Deck Temp. Reset	X				
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset					
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting					
Lighting Control			X		

	AI	AO	DI	DO	Total	Panel	Remarks
Multi-zone AHU's packaged (4 total)	24	8	4	8	44		
Single-zone AHU's packaged (3 total)	12	6	12	9	39		
Lighting				8	8		
						SFP,RTU	
<b>TOTALS</b>	<b>36</b>	<b>14</b>	<b>16</b>	<b>25</b>	<b>91</b>	<b>2</b>	

**Construction Cost.**

The estimated cost to install the UMCS control points in Building 4552 is **\$72,960**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$65,430
SIOH	\$ 3,600
Design	<u>\$ 3,930</u>
<b>TOTAL</b>	<b>\$72,960</b>

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$21,190**. Refer to Attachment 8.2D for ESA program output. Table 4552-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

### LCCID Inputs

Electric Energy Saved = 1,353.4 mmBtu  
(396,545 kWh x 3,413 Btu/kWh ÷  
1,000,000 Btu/mmBtu)

\$/mmBtu-Electric = \$9.40/mmBtu  
(\$12,690 ÷ 1,353.4 mmBtu)

Yearly Electric  
Demand Saved = 7.5 kW

Gas Energy Saved = 1,791.5 mmBtu  
(1,737.6 mcf x 1,031,000 Btu/mcf  
÷ 1,000,000 Btu/mmBtu)

\$/mmBtu - Gas = \$3.90/mmBtu  
(\$6,900 ÷ 1,791.5 mmBtu)

Construction \$ = \$65,430

SIOH \$ = \$3,600

Design \$ = \$3,930

Maintenance \$ = \$880 & \$4,430

Saving to Investment Ratio (SIR)	2.99
Simple Payback (Years)	2.84

#### Discussion.

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.



**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4552 - ADMINISTRATIVE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4552-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0				7.5		\$720
Day/Night Setback	1,704.7	884.4		232,312		12	\$11,280
Economizer (Dry Bulb)	304.1	237.4		17,386		10	\$1,770
Ventilation and Recirculation	200.6	175.4		5,793		10	\$1,160
Hot Deck/Cold Deck Temp. Reset	552.1	440.4		28,734			\$2,670
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	383.3			112,320			\$3,590
	0.0						\$0
<b>TOTALS</b>	<b>3,144.9</b>	<b>1,737.6</b>	<b>0</b>	<b>396,545</b>	<b>7.5</b>	<b>32</b>	<b>\$21,190</b>
		<b>\$6,900</b>	<b>\$0</b>	<b>\$12,690</b>	<b>\$720</b>	<b>\$880</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID    FY95    (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS.    3    CENSUS: 3

PROJECT NO. & TITLE: 4130.07    UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 4552

ANALYSIS DATE: 07-25-96    ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	65430.	
B. SIOH	\$	3600.	
C. DESIGN COST	\$	3930.	
D. TOTAL COST (1A+1B+1C)	\$	72960.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		72960.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	1353.	\$ 12722.	8.18	\$ 104066.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	1792.	\$ 6897.	9.51	\$ 65593.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 720.	8.07	\$ 5810.
N. TOTAL		3145.	\$ 20339.		\$ 175469.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$ 5310.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 42852.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 42852.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 25649.

5. SIMPLE PAYBACK PERIOD (1G/4) 2.84 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 218321.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 2.99  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 16.16 %

## **BUILDING BY BUILDING UMCS ANALYSIS**

### **BUILDING 4553 - ADMINISTRATIVE**

#### **Existing.**

In Building 4553, there are fifty-six (56) points currently connected to the existing EMCS, thirty-one (31) temperature monitoring (1 space temperature, 29 air temperature and 1 hot water supply temperature) and twenty-five (25) start/stop points (2 boiler, 4 pumps, 10 AHU's, and 9 condensing units). The only EMCS control in this building is monitoring. Nine packaged AHU's serve the building. Two per floor with a third unit serving part of the first floor. Each packaged unit has a DX coil, HW coil and a dedicated outdoor condensing unit. Two gas fired hot water boilers in basement serve the building.

#### **Proposed.**

Building 4553 is heated and cooled by multi-zone packaged air handling units and the DOE program was used to calculate UMCS Annual Energy Savings. The ESA program was used to calculate the boiler hot water outdoor air reset savings, demand savings and lighting savings. Refer to Attachment 8.2E for building envelope and equipment. Table 4553-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

#### **Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4553 - ADMINISTRATIVE  
UMCS STRATEGIES  
TABLE 4553-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS			
	Multizone AHU's	Single Zone AHU's	Boiler	Lighting
Scheduled Start/Stop				
Optimum Start/Stop				
Duty Cycling				
Demand Limiting	X	X		
Day/Night Setback	X	X		
Economizer (Dry Bulb)	X	X		
Ventilation and Recirculation	X	X		
Hot Deck/Cold Deck Temp. Reset	X			
Steam Boiler Selection				
Hot Water Boiler Selection				
Hot Water Outside Air Reset			X	
Chiller Selection				
Chilled Water Temp. Reset				
Chiller Demand Limiting				X
Lighting Control				

	AI	AO	DI	DO	Total	Panel	Remarks
Multi-zone packaged AHU's (6 total)	36	12	6	12	66		
Single-zone packaged AHU's (3 total)	12	6	12	9	39		
Hot Water Boiler (2 total)	16	2	2	4	24		
Lighting				8	8		
						SFP, RTU (2)	
<b>TOTALS</b>	<b>64</b>	<b>20</b>	<b>20</b>	<b>33</b>	<b>137</b>	<b>3</b>	

**Construction Cost.**

The estimated cost to install the UMCS control points in Building 4553 is **\$131,720**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$118,130
SIOH	\$ 6,500
Design	\$ 7,090
<b>TOTAL</b>	<b>\$131,720</b>

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$49,420**. Refer to Attachment 8.2E for ESA program output. Table 4553-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

### LCCID Inputs

Electric Energy Saved	=	2,350.2 mmBtu (688,030 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$22,030 ÷ 2,350.2 mmBtu)
Yearly Electric Demand Saved	=	14.9 kW
Gas Energy Saved	=	6,063.8 mmBtu (5,881.5 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$23,350 ÷ 6,063.8 mmBtu)
Construction \$	=	\$118,130
SIOH \$	=	\$6,500
Design \$	=	\$7,090
Maintenance \$	=	\$990 & \$6,900

Saving to Investment Ratio (SIR)	<b>3.63</b>
Simple Payback (Years)	<b>2.41</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4553 - ADMINISTRATIVE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4553-2**

UMCS Strategy	Energy Savings Summary					
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)
Scheduled Start/Stop	0.0					
Optimum Start/Stop	0.0					
Duty Cycling	0.0					
Demand Limiting	0.0				14.9	
Day/Night Setback	6,081.5	4,216.7		508,090		12
Economizer (Dry Bulb)	476.1	393.7		20,557		12
Ventilation and Recirculation	282.0	249.1		7,378		12
Hot Deck/Cold Deck Temp. Reset	691.8	570.8		30,263		
Steam Boiler Selection	0.0					
Hot Water Boiler Selection	0.0					
Hot Water Outside Air Reset	465.2	451.2				
Chiller Selection	0.0					
Chilled Water Temp. Reset	0.0					
Chiller Demand Limiting	0.0					
Lighting Control	417.4			122,304		
	0.0					
<b>TOTALS</b>	<b>8,414.0</b>	<b>5,881.5</b>	<b>0</b>	<b>688,592</b>	<b>14.9</b>	<b>36</b>
		<b>\$23,350</b>	<b>\$0</b>	<b>\$22,030</b>	<b>\$1,430</b>	<b>\$990</b>
						<b>\$47,800</b>

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID    FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS.    3    CENSUS:    3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 4553

ANALYSIS DATE:    07-25-96    ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	118130.		
B. SIOH	\$	6500.		
C. DESIGN COST	\$	7090.		
D. TOTAL COST (1A+1B+1C)	\$	131720.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)			\$	131720.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	2350.	\$ 22092.	8.18	\$ 180712.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	6064.	\$ 23346.	9.51	\$ 222017.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 1430.	8.07	\$ 11540.
N. TOTAL		8414.	\$ 46868.		\$ 414269.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)			
(1) DISCOUNT FACTOR (TABLE A)		8.07	\$ 7890.
(2) DISCOUNTED SAVING/COST (3A X 3A1)			\$ 63672.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 63672.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 54758.

5. SIMPLE PAYBACK PERIOD (1G/4) 2.41 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 477941.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 3.63  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 18.42 %



## **BUILDING BY BUILDING UMCS ANALYSIS**

### **BUILDING 4554 - ADMINISTRATIVE**

#### **Existing.**

In Building 4554, there are forty-two (42) points currently connected to the existing EMCS, twenty-two (22) temperature monitoring (21 air temperature and 1 hot water supply temperature) and twenty (20) start/stop points (2 boiler, 4 pump, 7 AHU's, and 7 condensing units). There is no occupied/unoccupied scheduling operational in the building. Eleven packaged AHU's serve the building. Two per floor with a third unit serving part of the second floor. Each packaged unit has a DX coil, HW coil, and a dedicated outdoor condensing unit. Two gas fired boilers in the basement serve the building. The enclosed porch areas are heated by packaged terminal air conditioning units with hot water coils.

#### **Proposed.**

Building 4554 is heated and cooled by multi-zone and single-zone packaged air handling units. The DOE program was used to calculate UMCS Annual Energy Savings. The ESA program was used to calculate the boiler hot water outdoor air reset savings, demand savings, and lighting savings. Refer to Attachment 8.2E for building envelope and equipment. Table 4554-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

#### **Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

**TABLE 4554-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	Multizone AHU's	Single Zone AHU's	Boiler	Lighting	
Scheduled Start/Stop					
Optimum Start/Stop					
Duty Cycling					
Demand Limiting	X	X			
Day/Night Setback	X	X			
Economizer (Dry Bulb)	X	X			
Ventilation and Recirculation	X	X			
Hot Deck/Cold Deck Temp. Reset	X				
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset			X		
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting					
Lighting Control				X	

	AI	AO	DI	DO	Total	Panel	Remarks
Multi-zone packaged AHU's (10 total)	60	20	10	20	110		
Single-zone packaged AHU	4	1	4	3	12		
Hot Water Boilers (2 total)	16	2	2	4	24		
Lighting				8	8		
						SFP, RTU(3)	
<b>TOTALS</b>	<b>80</b>	<b>23</b>	<b>16</b>	<b>35</b>	<b>154</b>	<b>4</b>	

**Construction Cost.**

The estimated cost to install the UMCS control points in Building 4554 is **\$131,500**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$117,930
SIOH	\$ 6,480
Design	<u>\$ 7,080</u>
<b>TOTAL</b>	<b>\$131,500</b>

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$57,490**. Refer to Attachment 8.2E for ESA program output. Table 4554-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

### LCCID Inputs

Electric Energy Saved	=	2,859.0 mmBtu (837,692 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$26,810 ÷ 2,859.0 mmBtu)
Yearly Electric Demand Saved	=	16.0 kW
Gas Energy Saved	=	7,257.6 mmBtu (7,039.4 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$27,950 ÷ 7,257.6 mmBtu)
Construction \$	=	\$117,930
SIOH \$	=	\$6,490
Design \$	=	\$7,080
Maintenance \$	=	\$1,210 & \$5,160

Saving to Investment Ratio (SIR)	<b>4.18</b>
Simple Payback (Years)	<b>2.10</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4554 - ADMINISTRATIVE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4554-2**

UMCS Strategy	Energy Savings Summary					
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)
Scheduled Start/Stop	0.0					
Optimum Start/Stop	0.0					
Duty Cycling	0.0					
Demand Limiting	0.0				16.0	
Day/Night Setback	7,510.1	5,169.6		638,802		17
Economizer (Dry Bulb)	550.8	454.8		23,985		17
Ventilation and Recirculation	287.4	254.0		7,480		10
Hot Deck/Cold Deck Temp. Reset	860.2	709.8		37,633		
Steam Boiler Selection	0.0					
Hot Water Boiler Selection	0.0					
Hot Water Outside Air Reset	465.2	451.2				
Chiller Selection	0.0					
Chilled Water Temp. Reset	0.0					
Chiller Demand Limiting	0.0					
Lighting Control	443.0			129,792		
	0.0					
<b>TOTALS</b>	<b>10,116.7</b>	<b>7,039.4</b>	<b>0</b>	<b>837,692</b>	<b>16.0</b>	<b>44</b>
		<b>\$27,950</b>	<b>\$0</b>	<b>\$26,810</b>	<b>\$1,540</b>	<b>\$1,210</b>
						<b>\$57,490</b>

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID    FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS.    3    CENSUS:    3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 4554

ANALYSIS DATE:    07-25-96    ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	117930.	
B. SIOH	\$	6490.	
C. DESIGN COST	\$	7080.	
D. TOTAL COST (1A+1B+1C)	\$	131500.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	131500.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	2859.	\$ 26875.	8.18	\$ 219834.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	7258.	\$ 27942.	9.51	\$ 265726.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 1540.	8.07	\$ 12428.
N. TOTAL		10117.	\$ 56356.		\$ 497988.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 6370.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 51406.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+) COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 51406.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 62726.

5. SIMPLE PAYBACK PERIOD (1G/4) 2.10 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 549394.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  4.18  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 20.10 %

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 4587 - EXCHANGE SERVICE OUTLET

- Existing.** Building 4587, is not currently connected to the existing EMCS. Four oil fired furnaces heat the garage area and an oil fired furnace with DX cooling conditions the office.
- Proposed.** The service outlet portion of Building 4587 is heated by oil fired duct furnaces in the garage and an oil fired furnace with a DX coil for the office area. The warehouse area is heated by electric unit heaters and will not be included. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2F for building envelope and equipment. Table 4587-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.
- Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Duct Furnaces	4		4	4	12		
Office AC Unit	2	1	3	2	8		
						UPC	
TOTALS	6	1	7	6	20	1	

**TABLE 4587-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS						
	Duct Furnaces	A/C Unit					
Scheduled Start/Stop							
Optimum Start/Stop							
Duty Cycling							
Demand Limiting							
Day/Night Setback	X	X					
Economizer (Dry Bulb)		X					
Ventilation and Recirculation		X					
Hot Deck/Cold Deck Temp. Reset							
Steam Boiler Selection							
Hot Water Boiler Selection							
Hot Water Outside Air Reset							
Chiller Selection							
Chilled Water Temp. Reset							
Chiller Demand Limiting							
Lighting Control							



**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 4587 is **\$12,270**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$11,000
SIOH	\$ 610
Design	<u>\$ 660</u>
TOTAL	\$12,270

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$1,400**. Refer to Attachment 8.2F for ESA program output. Table 4587-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

LCCID Inputs

Electric Energy Saved	=	7.7 mmBtu (2,267 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.10/mmBtu (\$70 ÷ 7.7 mmBtu)
Oil Energy Saved	=	248.6 mmBtu (1,792 gal x 138,700 Btu/gal ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Oil	=	\$4.50/mmBtu (\$1,110 ÷ 248.6 mmBtu)
Construction \$	=	\$11,000
SIOH \$	=	\$610

Design \$ = \$660

Maintenance \$ = \$220

Saving to Investment Ratio (SIR)	<b>1.07</b>
Simple Payback (Years)	<b>8.70</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4587 - EXCHANGE SERVICE OUTLET  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4587-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	202.2		1,405	2,132		4	\$1,050
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	49.3		352	135		4	\$330
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	4.9		35				\$20
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
<b>TOTALS</b>	<b>256</b>	<b>0</b>	<b>1,792</b>	<b>2,267</b>	<b>0</b>	<b>8</b>	<b>\$1,400</b>
		<b>\$0</b>	<b>\$1,110</b>	<b>\$70</b>	<b>\$0</b>	<b>\$220</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 4587

ANALYSIS DATE: 07-11-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	11000.		
B. SIOH	\$	610.		
C. DESIGN COST	\$	660.		
D. TOTAL COST (1A+1B+1C)	\$	12270.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		12270.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	8.	\$ 72.	8.18	\$ 592.
B. DIST	\$ 4.50	249.	\$ 1119.	9.64	\$ 10784.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	0.	\$ 0.	9.51	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		256.	\$ 1191.		\$ 11376.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	220.
(1) DISCOUNT FACTOR (TABLE A)	8.07		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	1775.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
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d. TOTAL	\$	0.		0.
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C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4)	\$	1775.
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4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$	\$	1411.
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5. SIMPLE PAYBACK PERIOD (1G/4)	8.70 YEARS
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6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	\$	13152.
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7. SAVINGS TO INVESTMENT RATIO (SIR) = $(6 / 1G) =$	1.07
(IF < 1 PROJECT DOES NOT QUALIFY)	

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):	4.82 %
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## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 4675 - EXCHANGE SERVICE OUTLET

**Existing.** Building 4675 is not currently connected to the existing EMCS. A heat pump conditions building with supplemental electric heat and an outdoor condensing unit.

**Proposed.** Building 4675 is heated and cooled by split-system air handling unit and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2F for building envelope and equipment. Table 4675-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	2	1	3	2	8		
						UC	
TOTALS	2	1	3	2	8	1	

### Construction Cost.

The estimated cost to install the UMCS control points in Building 4675 is **\$6,350**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$5,700
SIOH	\$ 310
Design	<u>\$ 340</u>
TOTAL	\$6,350

**TABLE 4675-1**

	Mechanical Systems Controlled By UMCS						
	AHU-1						
<b>UMCS Strategy</b>							
Scheduled Start/Stop	X						
Optimum Start/Stop	X						
Duty Cycling	X						
Demand Limiting	X						
Day/Night Setback	X						
Economizer (Dry Bulb)							
Ventilation and Recirculation							
Hot Deck/Cold Deck Temp. Reset							
Steam Boiler Selection							
Hot Water Boiler Selection							
Hot Water Outside Air Reset							
Chiller Selection							
Chilled Water Temp. Reset							
Chiller Demand Limiting							
Lighting Control							

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$600**. Refer to Attachment 8.2F for ESA program output. Table 4675-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved = 48.9 mmBtu  
(14,335 kWh x 3,413 Btu/kWh ÷  
1,000,000 Btu/mmBtu)

\$/mmBtu-Electric = \$9.40/mmBtu  
(\$460 ÷ 48.9 mmBtu)

Yearly Electric  
Demand Saved = 0.3 kW

Construction \$ = \$5,700

SIOH \$ = \$310

Design \$ = \$340

Maintenance \$ = \$110

Saving to Investment Ratio (SIR)	<b>0.77</b>
Simple Payback (Years)	<b>10.59</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

## TABLE 4675-2

Cost Savings Based on:	\$/mcf	\$/Gal	\$/kWh	\$/kW	\$/mh
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LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 4675

ANALYSIS DATE: 07-15-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	5700.		
B. SIOH	\$	310.		
C. DESIGN COST	\$	340.		
D. TOTAL COST (1A+1B+1C)	\$	6350.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$			6350.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	49.	\$ 460.	8.18	\$ 3760.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	0.	\$ 0.	9.51	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 30.	8.07	\$ 242.
N. TOTAL		49.	\$ 490.		\$ 4002.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		
(1) DISCOUNT FACTOR (TABLE A)	8.07	\$ 110.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 888.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+) / COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) / COST(-) (3A2+3Bd4) \$ 888.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 600.

5. SIMPLE PAYBACK PERIOD (1G/4) 10.59 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 4890.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .77$   
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 1.42 %

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 4680 - EXCHANGE SERVICE STATION

### Existing.

In Building 4680, there are four (4) points currently connected to the existing EMCS, two (2) temperature monitoring (low and high space temperature) and two (2) start/stop points (boiler and air compressor). All points in this building are monitoring points only. Four hot water unit heaters heat the garage with hot water being supplied by an oil fired hot water boiler. A split system AHU heats and cools the office with hot water coil and DX coil.

### Proposed.

Building 4680, the garage area, is heated by hot water unit heaters and the office area is heated and cooled by a split system air handling unit. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2F for building envelope and equipment. Table 4680-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

### Point List.

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	2	1	3	2	8		
Hot Water Boiler	4	1	1	2	8		
						UPC	
TOTALS	6	2	4	4	16	1	

## TABLE 4680-1

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**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 4680 is **\$30,500**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$27,360
SIOH	\$ 1,500
Design	<u>\$ 1,640</u>
TOTAL	\$30,500

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$600**. Refer to Attachment 8.2F for ESA program output. Table 4680-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

LCCID Inputs

Electric Energy Saved	=	0.7 mmBtu (200 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$14.60/mmBtu (\$10 ÷ 0.7 mmBtu)
Oil Energy Saved	=	83.4 mmBtu (601 gal x 138,700 Btu/gal ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Oil	=	\$4.40/mmBtu (\$370 ÷ 83.4 mmBtu)
Construction \$	=	\$27,360
SIOH \$	=	\$1,500

Design \$ = \$1,640

Maintenance \$ = \$220 & \$500

Saving to Investment Ratio (SIR)	<b>0.31</b>
Simple Payback (Years)	<b>27.68</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4680 - EXCHANGE SERVICE STATION  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4680-2**

UMCS Strategy	Energy Savings Summary						Cost Savings
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	26.1		183	200		4	\$230
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	6.1		44				\$30
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	51.9		374			4	\$340
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
<b>TOTALS</b>	<b>84.0</b>	<b>0</b>	<b>601</b>	<b>200</b>	<b>0</b>	<b>8</b>	<b>\$600</b>
		<b>\$0</b>	<b>\$370</b>	<b>\$10</b>	<b>\$0</b>	<b>\$220</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      STUDY: MEADE2  
 INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      LCCID FY95 (92)  
 PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY      CENSUS: 3  
 FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 4680  
 ANALYSIS DATE: 07-11-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	27360.	
B. SIOH	\$	1500.	
C. DESIGN COST	\$	1640.	
D. TOTAL COST (1A+1B+1C)	\$	30500.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		30500.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	1.	\$ 7.	8.18	\$ 54.
B. DIST	\$ 4.50	83.	\$ 375.	9.64	\$ 3618.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	0.	\$ 0.	9.51	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		84.	\$ 382.		\$ 3672.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	720.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	5810.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 5810.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 1102.

5. SIMPLE PAYBACK PERIOD (1G/4) 27.68 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 9482.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .31$   
 (IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

## **BUILDING BY BUILDING UMCS ANALYSIS BUILDING 4700 - BAND TRAINING FACILITY**

### **Existing.**

In Building 4700, there are thirty-three (33) points currently connected to the existing EMCS, twenty-three (23) temperature monitoring (1 space temperature, 20 air temperature points, and 2 hot water supply temperature) and ten (10) start/stop points (1 boiler and 9 AHU's). Four AHU's are out of service. These points are monitoring only points. The band rehearsal room is heated and cooled by an AHU with a steam coil and DX coil with an outdoor condenser. Other areas are cooled by a packaged or split system DX cooling unit and are heated by perimeter steam radiation. A gas fired steam boiler provides steam.

### **Proposed.**

Building 4700 is heated by steam radiators and cooled by packaged air handling units and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2F for building envelope and equipment. Table 4700-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

### **Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.



## TABLE 4700-1

UMCS Strategy	Mechanical Systems Controlled By UMCS					
	Steam Radiation	A/C-1	A/C-2	A/C-3	A/C-4	A/C-5
Scheduled Start/Stop			X	X	X	X
Optimum Start/Stop			X	X	X	X
Duty Cycling			X	X	X	X
Demand Limiting			X	X	X	X
Day/Night Setback	X	X				
Economizer (Dry Bulb)		X	X	X	X	X
Ventilation and Recirculation		X	X	X	X	X
Hot Deck/Cold Deck Temp. Reset						
Steam Boiler Selection						
Hot Water Boiler Selection						
Hot Water Outside Air Reset						
Chiller Selection						
Chilled Water Temp. Reset						
Chiller Demand Limiting						
Lighting Control						

	AI	AO	DI	DO	Total	Panel	Remarks
AC-1	2	1	3	2	8		
AC-2	5		3	2	10		Outdoor air damper control not included
AC-3	5		3	2	10		Outdoor air damper control not included
AC-4	5		3	2	10		Outdoor air damper control not included
AC-5	5		3	2	10		Outdoor air damper control not included
Steam Radiation			1	1	2		Space sensors included under AC units
						SFP	
TOTALS	22	1	16	11	50	1	

**Construction Cost.**

The estimated cost to install the UMCS control points in Building 4700 is **\$43,170**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$38,720
SIOH	\$ 2,130
Design	<u>\$ 2,320</u>
TOTAL	\$43,170

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$5,290**. Refer to Attachment 8.2F for ESA program output. Table 4700-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

### LCCID Inputs

Electric Energy Saved	=	21.1 mmBtu (6,177 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.50/mmBtu (\$200 ÷ 21.1 mmBtu)
Yearly Electric Demand Saved	=	0.7 kW
Gas Energy Saved	=	1,133.2 mmBtu (1,099.1 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$4,360 ÷ 1,133.2 mmBtu)
Construction \$	=	\$38,720
SIOH \$	=	\$2,130
Design \$	=	\$2,320
Maintenance \$	=	\$660 & \$4,060

Saving to Investment Ratio (SIR)	<b>1.89</b>
Simple Payback (Years)	<b>4.62</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4700 - BAND TRAINING FACILITY  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4700-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	13.5			3,965		8	\$350
Optimum Start/Stop	0.0						\$0
Duty Cycling	5.7			1,659		8	\$270
Demand Limiting	0.0				0.7		\$70
Day/Night Setback	1,127.3	1,091.6		553		8	\$4,570
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	7.7	7.5					\$30
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
	0.0						\$0
<b>TOTALS</b>	<b>1,154.3</b>	<b>1,099.1</b>	<b>0</b>	<b>6,177</b>	<b>0.7</b>	<b>24</b>	<b>\$5,290</b>
		<b>\$4,360</b>	<b>\$0</b>	<b>\$200</b>	<b>\$70</b>	<b>\$660</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 4700

ANALYSIS DATE: 07-15-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	38720.		
B. SIOH	\$	2130.		
C. DESIGN COST	\$	2320.		
D. TOTAL COST (1A+1B+1C)	\$	43170.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$		0.	
F. PUBLIC UTILITY COMPANY REBATE	\$		0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$			43170.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	21.	\$ 198.	8.18	\$ 1622.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	1133.	\$ 4363.	9.51	\$ 41490.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 70.	8.07	\$ 565.
N. TOTAL		1154.	\$ 4631.		\$ 43678.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		
(1) DISCOUNT FACTOR (TABLE A)	8.07	\$ 4720.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 38090.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 38090.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 9351.

5. SIMPLE PAYBACK PERIOD (1G/4) 4.62 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 81768.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  1.89  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 10.97 %

**BUILDING BY BUILDING UMCS ANALYSIS**  
**BUILDINGS 4703, 4704, 4717, 4720, and 4721 - OFFICERS' QUARTERS**

**Existing.**

In Buildings 4703 and 4704, there are three (3) points currently connected from each building to the existing EMCS, two (2) temperature monitoring (high and low space temperature) and one (1) start/stop point (boiler). Building 4720 houses the boiler and chiller that provide dual temperature water to Buildings 4717, 4720, and 4721. In Building 4720, there are eight (8) points currently connected to the existing EMCS, four (4) temperature monitoring points (1 space temperature, 2 chilled water temperature, and 1 hot water supply temperature) and four (4) start/stop points (3 dual temperature pumps and 1 boiler). These points are monitoring only points. Two pipe fan coil units in each room condition each building with no outside air. A gas-fired hot water boiler and a 20 ton chiller air cooled chiller provide hot and chilled water in Building 4703 and 4704. Buildings 4717, 4720 and 4721 are the same as 4703 and 4704 except a single hot water boiler and 60 ton air cooled chiller located in Building 4720 provide hot and chilled water to all three buildings.

**Proposed.**

These buildings are heated and cooled by fan coil units and only the ESA program was used to calculate UMCS Annual Energy Savings. Buildings 4703 and 4704 each have a hot water boiler and air cooled chiller providing dual temperature water to the individual fan coil units. For Buildings 4717, 4720, and 4721, a single hot water boiler and air cooled chiller provide dual temperature water to all three buildings. All four buildings have similar square footage and mechanical systems and have been considered to have equivalent savings. The ESA program was run for Building 4703 and multiplied by five for a total energy savings. Refer to Attachment 8.2F for building envelope and equipment. Table 4703-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

**TABLE 4703-1**

# Mechanical Systems Controlled By UMCS

	AI	AO	DI	DO	Total	Panel	Remarks
HW Boiler 4703	8	1	1	2	12	UPC	
Air Cooled Chiller 4703	6	1	3	2	12		
HW Boiler 4704	8	1	1	2	12	UPC	
Air Cooled Chiller 4704	6	1	3	2	12		
HW Boiler 4720	8	1	1	2	12	SFP	
Air Cooled Chiller 4720	6	1	3	2	12		
TOTALS	42	6	12	12	72	3	

**Construction Cost.**

The estimated cost to install the UMCS control points in Buildings 4703, 4704, 4717, 4720, and 4721 is **\$93,890**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$84,210
SIOH	\$ 4,630
Design Fee	<u>\$ 5,050</u>
TOTAL	\$93,890

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$2,640**. Refer to Attachment 8.2F for ESA program output. Table 4703-2 shows the individual strategy savings.



**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	18.5 mmBtu (5,430 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.20/mmBtu (\$170 ÷ 18.5 mmBtu)
Gas Energy Saved	=	470.1 mmBtu (456 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$1,810 ÷ 470.1 mmBtu)
Construction \$	=	\$84,210
SIOH \$	=	\$4,630
Design \$	=	\$5,050
Maintenance \$	=	\$660 & \$1,720

Saving to Investment Ratio (SIR)	<b>0.40</b>
Simple Payback (Years)	<b>21.52</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4703 - OFFICERS QUARTERS  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4703-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	0.0						\$0
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	470.1	456.0				12	\$2,140
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	18.5			5,430		12	\$500
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
	0.0						\$0
<b>TOTALS</b>	<b>488.7</b>	<b>456.0</b>	<b>0</b>	<b>5,430</b>	<b>0</b>	<b>24</b>	<b>\$2,640</b>
		<b>\$1,810</b>	<b>\$0</b>	<b>\$170</b>	<b>\$0</b>	<b>\$660</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 4703

ANALYSIS DATE: 07-11-96      ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	84210.		
B. SIOH	\$	4630.		
C. DESIGN COST	\$	5050.		
D. TOTAL COST (1A+1B+1C)	\$	93890.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		\$	93890.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	19.	\$ 174.	8.18	\$ 1423.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	470.	\$ 1810.	9.51	\$ 17212.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		489.	\$ 1984.		\$ 18635.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	2380.
(1) DISCOUNT FACTOR (TABLE A)	8.07		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	19207.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 19207.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 4364.

5. SIMPLE PAYBACK PERIOD (1G/4) 21.52 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 37841.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .40$   
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

## **BUILDING BY BUILDING UMCS ANALYSIS**

### **BUILDINGS 4705, 4707 AND 4709 - OFFICERS' QUARTERS**

- Existing.** In Buildings 4705, 4707, and 4709, there are three (3) points currently connected from each building to the existing EMCS, two (2) temperature monitoring (high and low space temperature) and one start/stop point (boiler). These points are monitoring only points. Two pipe fan coil units in each room condition the buildings with no outside air. A gas fired hot water boiler and a 40 ton air cooled chiller are located in each building for providing hot and chilled water.
- Proposed.** These three buildings are heated and cooled by fan coil units, and only the ESA program was used to calculate UMCS Annual Energy Savings. Buildings 4705, 4707, and 4709 each have a hot water boiler and an air cooled chiller providing dual temperature water to the individual fan coil units. The ESA program was run for Building 4705 and multiplied by 3 for a total energy savings. All three buildings have similar square footage and mechanical systems and have been considered to have equivalent savings.
- Refer to Attachment 8.2F for building envelope and equipment. Table 4705-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.
- Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

**TABLE 4705-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS			
	Fan Coils	Hot Water Boiler	Air Cooled Chiller	
Scheduled Start/Stop				
Optimum Start/Stop				
Duty Cycling				
Demand Limiting				
Day/Night Setback				
Economizer (Dry Bulb)				
Ventilation and Recirculation				
Hot Deck/Cold Deck Temp. Reset				
Steam Boiler Selection				
Hot Water Boiler Selection				
Hot Water Outside Air Reset		X		
Chiller Selection				
Chilled Water Temp. Reset			X	
Chiller Demand Limiting				
Lighting Control				

	AI	AO	DI	DO	Total	Panel	Remarks
HW Boiler 4705	8	1	1	2	12	UPC	
Air Cooled Chiller 4705	6	1	3	2	12	UPC	
HW Boiler 4707	8	1	1	2	12	UPC	
Air Cooled Chiller 4705	6	1	3	2	12	UPC	
HW Boiler 4709	8	1	1	2	12	UPC	
Air Cooled Chiller 4709	6	1	3	2	12	UPC	
TOTALS	42	6	12	12	72	6	

**Construction Cost.**

The estimated cost to install the UMCS control points in Buildings 4705, 4707, and 4709 is **\$81,980**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$73,530
SIOH	\$ 4,040
Design	<u>\$ 4,410</u>
TOTAL	\$81,980

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$2,370**. Refer to Attachment 8.2F for ESA program output. Table 4705-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	22.2 mmBtu (6,516 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$210 ÷ 22.2 mmBtu)
Gas Energy Saved	=	388.7 mmBtu (377.1 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$1,500 ÷ 388.7 mmBtu)
Construction \$	=	\$73,530
SIOH \$	=	\$4,040
Design \$	=	\$4,410
Maintenance \$	=	\$660 & \$1,110

Saving to Investment Ratio (SIR)	<b>0.37</b>
Simple Payback (Years)	<b>23.59</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 4705 - OFFICERS QUARTERS  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 4705-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	0.0						\$0
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	388.8	377.1				12	\$1,830
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	22.2			6,516		12	\$540
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
	0.0						\$0
<b>TOTALS</b>	<b>411.0</b>	<b>377.1</b>	<b>0</b>	<b>6,516</b>	<b>0</b>	<b>24</b>	<b>\$2,370</b>
		<b>\$1,500</b>	<b>\$0</b>	<b>\$210</b>	<b>\$0</b>	<b>\$660</b>	

Cost Savings Based on:

\$/mcf \$3.97  
 \$/Gal \$0.62  
 \$/kWh \$0.032  
 \$/kW \$96.28  
 \$/mh \$27.50



LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 4705

ANALYSIS DATE: 07-11-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	73530.	
B. SIOH	\$	4040.	
C. DESIGN COST	\$	4410.	
D. TOTAL COST (1A+1B+1C)	\$	81980.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		81980.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	22.	\$ 209.	8.18	\$ 1707.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	389.	\$ 1496.	9.51	\$ 14232.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		411.	\$ 1705.		\$ 15939.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$ 1770.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 14284.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 14284.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 3475.

5. SIMPLE PAYBACK PERIOD (1G/4) 23.59 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 30223.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .37$   
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 6330 - PHYSICAL FITNESS CENTER

### Existing.

In Building 6330, there are thirteen (13) points currently connected to the existing EMCS, eight (8) temperature monitoring points (four air temperature and four water temperature) and five (5) start/stop points (two boilers, one pump, and two H&V units). The only control is occupied/unoccupied scheduling and point monitoring. The gym is heated and ventilated only by a single AHU with a hot water coil. The basement, pool and remaining areas are heated and ventilated only by a single AHU with a hot water coil. Office areas have cooling only packaged terminal units. Reheat coils provided for remote areas. A gas fired hot water boiler provides hot water for heating.

### Proposed.

Building 6330 is heated by heating and ventilating units and only the offices are cooled by packaged terminal units. The DOE program was used to calculate UMCS Annual Energy Savings. The ESA program was used to calculate hot water outside air reset savings. Refer to Attachment 8.2F for building envelope and equipment. Table 6330-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

### Point List.

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991.

	AI	AO	DI	DO	Total	Panel	Remarks
H&V-1	3	2	2	1	8		
Hot Water Boiler	8	1	1	2	12		
H&V-2	3	2	2	1	8		
						RTU	
TOTALS	14	5	5	4	28	1	

**TABLE 6330-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	H&V-1	H&V-2	Heating Boiler		
Scheduled Start/Stop					
Optimum Start/Stop					
Duty Cycling					
Demand Limiting					
Day/Night Setback	X	X			
Economizer (Dry Bulb)					
Ventilation and Recirculation	X	X			
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset			X		
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting					
Lighting Control					

**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 6330 is **\$36,680**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$32,900
SIOH	\$ 1,810
Design	<u>\$ 1,970</u>
TOTAL	\$36,680

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$20,440**. Refer to Attachment 8.2F for DOE program output. Table 6330-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

LCCID Inputs

Electric Energy Saved	=	470.8 mmBtu (137,952 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$4,410 ÷ 470.8 mmBtu)
Gas Energy Saved	=	4,044.1 mmBtu (3,922.5 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$15,570 ÷ 4,044.1 mmBtu)
Construction \$	=	\$32,900
SIOH \$	=	\$1,810

Design \$ = \$1,970

Maintenance \$ = \$440 & \$1,600

Saving to Investment Ratio (SIR)	<b>5.47</b>
Simple Payback (Years)	<b>1.66</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 6330 - PHYSICAL FITNESS CENTER  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 6330-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	2,945.7	2,433.5		127,978		8	\$13,990
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	1,377.2	1,302.8		9,974		4	\$5,600
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	192.0	186.2				4	\$850
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
TOTALS	4,514.9	3,922.5	0	137,952	0.0	16	\$20,440
		\$15,570	\$0	\$4,410	\$0	\$440	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)                      STUDY: MEADE  
 INSTALLATION & LOCATION: FORT MEADE                      REGION NOS. 3                      LCCID FY95 (92)  
 PROJECT NO. & TITLE: 4130.07                      UMCS FEASIBILITY STUDY                      CENSUS: 3  
 FISCAL YEAR 1996                      DISCRETE PORTION NAME: BLDG 6330  
 ANALYSIS DATE: 07-11-96                      ECONOMIC LIFE 10 YEARS                      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	32900.		
B. SIOH	\$	1810.		
C. DESIGN COST	\$	1970.		
D. TOTAL COST (1A+1B+1C)	\$	36680.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)			\$	36680.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	471.	\$ 4426.	8.18	\$ 36201.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	4044.	\$ 15570.	9.51	\$ 148069.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		4515.	\$ 19995.		\$ 184269.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	2040.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	16463.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
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d. TOTAL	\$	0.		0.
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C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)	\$	16463.
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4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))	\$	22035.
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5. SIMPLE PAYBACK PERIOD (1G/4)	1.66 YEARS
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6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	\$	200732.
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7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)=	5.47
(IF < 1 PROJECT DOES NOT QUALIFY)	

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):	23.39 %
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## **BUILDING BY BUILDING UMCS ANALYSIS BUILDING 6530 - SKILL DEVELOPMENT CENTER**

**Existing.**

In Building 6530, there are fourteen (14) points currently connected to the existing EMCS, eight (8) temperature monitoring (1 space temperature, 5 air temperatures, and 2 hot water supply and return temperatures) and six (6) start/stop points (boiler, 2 AHUs, HV unit, solenoid valve, and circulating pump). These points are monitoring only points. AHU's heat and cool the craft area and office areas of the buildings with HW coils and DX coils. Outdoor condensing units are dedicated to each AHU. Hot water unit heaters heat the garage area and a hot water heating and ventilating unit ventilates the garage area. A gas fired hot water boiler provides hot water.

**Proposed.**

Building 6530 is heated by a natural gas-fired boiler supplying hot water to unit heaters, air handling units, heating and ventilating units, and fin tube radiation. Cooling is provided by individual DX condensing units and coils. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2F for building envelope and equipment. Table 6530-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.



**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 6530 - SKILL DEVELOPMENT CENTER  
UMCS STRATEGIES  
TABLE 6530-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	AHU-1	AHU-2	Boiler	H&V-1 Garage	H&V-1 Unit Heaters
Scheduled Start/Stop	X			X	
Optimum Start/Stop	X			X	
Duty Cycling					
Demand Limiting	X	X			
Day/Night Setback		X		X	X
Economizer (Dry Bulb)	X	X			
Ventilation and Recirculation	X	X		X	
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset			X		
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting					
Lighting Control					
Reheat Coil Reset	X				

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	4	2	4	3	13		
AHU-2	5		3	3	11		
H&V Woodworking	3	2	2	1	8		
H&V Garage	3		2	2	7		
Unit Heaters	4		3	3	10		Includes additional pumps
Boiler	8	1	1	2	12		
						SFP,RCU	
TOTALS	27	5	15	14	61	1	

**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 6530 is **\$60,640**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$54,390
SIOH	\$ 2,990
Design	<u>\$ 3,260</u>
TOTAL	\$60,640

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$8,990**. Refer to Attachment 8.2F for ESA program output. Table 6530-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

### LCCID Inputs

Electric Energy Saved = 148.7 mmBtu  
(43,572 kWh x 3,413 Btu/kWh ÷  
1,000,000 Btu/mmBtu)

\$/mmBtu-Electric = \$9.30/mmBtu  
(\$1,390 ÷ 148.7 mmBtu)

Yearly Electric  
Demand Saved = 0.9 kW

Gas Energy Saved = 1,807.2 mmBtu  
(1,752.9 mcf x 1,031,000 Btu/mcf  
÷ 1,000,000 Btu/mmBtu)

\$/mmBtu - Gas = \$3.90/mmBtu  
(\$6,960 ÷ 1,807.2 mmBtu)

Construction \$ = \$54,390

SIOH \$ = \$2,990

Design \$ = \$3,260

Maintenance \$ = \$550 & \$1,720

Saving to Investment Ratio (SIR)	1.59
Simple Payback (Years)	5.66

#### Discussion.

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 6530 - SKILL DEVELOPMENT CENTER  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 6530-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	930.1	854.9		14,279		4	\$3,960
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0				0.9		\$90
Day/Night Setback	193.5	187.3		107		4	\$860
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	38.8	37.6				4	\$260
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	187.5	181.9				4	\$830
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
Reheat Coil Reset	606.0	491.2		29,186		4	\$2,990
<b>TOTALS</b>	<b>1,956.0</b>	<b>1,752.9</b>	<b>0</b>	<b>43,572</b>	<b>0.9</b>	<b>20</b>	<b>\$8,990</b>
		<b>\$6,960</b>	<b>\$0</b>	<b>\$1,390</b>	<b>\$90</b>	<b>\$550</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 6530

ANALYSIS DATE: 07-15-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	54390.		
B. SIOH	\$	2990.		
C. DESIGN COST	\$	3260.		
D. TOTAL COST (1A+1B+1C)	\$	60640.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$		0.	
F. PUBLIC UTILITY COMPANY REBATE	\$		0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$			60640.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	149.	\$ 1398.	8.18	\$ 11434.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	1807.	\$ 6958.	9.51	\$ 66168.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 90.	8.07	\$ 726.
N. TOTAL		1956.	\$ 8446.		\$ 78328.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		
(1) DISCOUNT FACTOR (TABLE A)	8.07	\$ 2270.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 18319.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 18319.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 10716.

5. SIMPLE PAYBACK PERIOD (1G/4) 5.66 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 96647.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  1.59  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 9.07 %

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 6600 - OFFICER'S CLUB

### Existing.

In Building 6600, there are four (4) points currently connected to the existing EMCS, three (3) temperature monitoring (space temperature, and hot water supply and return temperatures) and one (1) start/stop point (boiler). These points are monitoring only points. Nine AHU's heat and cool the building. One unit for each individual space. Each unit has a chilled and hot water coil. Two gas fired hot water boilers and an air cooled 100 ton chiller provide hot and chilled water. Fan coil units condition the small offices and lobby.

### Proposed.

Building 6600 is heated and cooled by air handling units and fan coils and the DOE program was used to calculate UMCS Annual Energy Savings. The ESA program was used to calculate the AHU demand limiting savings and chiller savings only. Refer to Attachment 8.2F for building envelope and equipment. Table 6600-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

### Point List.

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
AHUs (9 total)	45	27	18	9	99		
Hot Water Boiler	8	1	3	4	16		Includes additional pumps
Air Cooled Chiller	6	1	3	2	12		
						SFP, RTU (2)	
TOTALS	59	29	24	15	127	3	

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 6600 - OFFICER'S CLUB  
UMCS STRATEGIES  
TABLE 6600-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	AHU's 1 thru 8	AHU-9	Boiler	Chiller	
Scheduled Start/Stop				X	
Optimum Start/Stop				X	
Duty Cycling					
Demand Limiting	X				
Day/Night Setback	X	X			
Economizer (Dry Bulb)	X	X			
Ventilation and Recirculation	X	X			
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset			X		
Chiller Selection					
Chilled Water Temp. Reset				X	
Chiller Demand Limiting					
Lighting Control					

**Construction****Cost.**

The estimated cost to install the UMCS control points in Building 6600 is **\$113,090**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$101,420
SIOH	\$ 5,580
Design	<u>\$ 6,090</u>
TOTAL	\$113,090

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$13,920**. Refer to Attachment 8.2F for ESA program output. Table 6600-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	755.1 mmBtu (221,231 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$7,080 ÷ 755.1 mmBtu)
Yearly Electric Demand Saved	=	4.3 kW
Gas Energy Saved	=	1,355.1 mmBtu (1,314.4 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$5,220 ÷ 1,355.1 mmBtu)
Construction \$	=	\$101,420



SIOH \$ = \$5,580

Design \$ = \$6,090

Maintenance \$ = \$1,210 & \$500

Saving to Investment Ratio (SIR)	<b>1.10</b>
Simple Payback (Years)	<b>7.83</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 6600 - OFFICER'S CLUB  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 6600-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	8.0			2,355			\$80
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0				4.3		\$410
Day/Night Setback	1,544.8	817.9		205,549		12	\$10,150
Economizer (Dry Bulb)	233.1	200.6		7,697		12	\$1,370
Ventilation and Recirculation	172.3	164.7		744		12	\$1,010
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	135.3	131.2				4	\$630
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	16.7			4,886		4	\$270
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
TOTALS	2,110.2	1,314.4	0	221,231	4.3	44	\$13,920
		\$5,220	\$0	\$7,080	\$410	\$1,210	

Cost Savings Based on:

\$/mcf \$3.97  
 \$/Gal \$0.62  
 \$/kWh \$0.032  
 \$/kW \$96.28  
 \$/mh \$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 6600

ANALYSIS DATE: 07-15-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	101420.		
B. SIOH	\$	5580.		
C. DESIGN COST	\$	6090.		
D. TOTAL COST (1A+1B+1C)	\$	113090.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		113090.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	755.	\$ 7098.	8.18	\$ 58061.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	1355.	\$ 5217.	9.51	\$ 49615.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 410.	8.07	\$ 3309.
N. TOTAL		2110.	\$ 12725.		\$ 110985.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$ 1710.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 13800.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
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d. TOTAL	\$ 0.			0.
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C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4)	\$ 13800.
--	-----------

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$	\$ 14435.
--	-----------

5. SIMPLE PAYBACK PERIOD (1G/4)	7.83 YEARS
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6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	\$ 124785.
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7. SAVINGS TO INVESTMENT RATIO (SIR) = $(6 / 1G) =$	1.10
(IF < 1 PROJECT DOES NOT QUALIFY)	

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR) :	5.13 %
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## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 6800 - CLUB HOUSE

**Existing.** Building 6800 is not currently connected to the existing EMCS. Five rooftop package VAV units condition the building with gas heat and DX cooling.

**Proposed.** Building 6800 is heated and cooled by rooftop packaged VAV units with gas heating and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2F for building envelope and equipment. Table 6800-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
RTU-A	3			1	4		
RTU-B	3			1	4		
RTU-C	3			1	4		
RTU-D	3			1	4		
RTU-E	3			1	4		
						SFP	
TOTALS	15	0	0	5	20	1	

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 6800 - CLUB HOUSE  
UMCS STRATEGIES  
TABLE 6800-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	RTU-A	RTU-B	RTU-C	RTU-D	RTU-E
Scheduled Start/Stop					
Optimum Start/Stop					
Duty Cycling					
Demand Limiting	X	X	X	X	X
Day/Night Setback	X	X	X	X	X
Economizer (Dry Bulb)	X	X	X	X	X
Ventilation and Recirculation	X	X	X	X	X
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset					
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting					
Lighting Control					

**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 6800 is **\$12,980**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$11,640
SIOH	\$ 640
Design	<u>\$ 700</u>
TOTAL	\$12,980

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$1,420**. Refer to Attachment 8.2F for ESA program output. Table 6800-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

LCCID Inputs

Electric Energy Saved	=	0.9 mmBtu (275 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$10.60/mmBtu (\$10 ÷ 0.9 mmBtu)
Yearly Electric Demand Saved	=	3.0 kW
Gas Energy Saved	=	146.2 mmBtu (141.8 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$560 ÷ 146.2 mmBtu)
Construction \$	=	\$11,640

SIOH \$ = \$640

Design \$ = \$700

Maintenance \$ = \$550

Saving to Investment Ratio (SIR)	<b>0.94</b>
Simple Payback (Years)	<b>9.20</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 6800 - CLUB HOUSE  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 6800-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0				3.0		\$290
Day/Night Setback	85.7	82.2		275		12	\$670
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	61.4	59.6				8	\$460
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
<b>TOTALS</b>	<b>147.1</b>	<b>141.8</b>	<b>0</b>	<b>275</b>	<b>3.0</b>	<b>20</b>	<b>\$1,420</b>
		<b>\$560</b>	<b>\$0</b>	<b>\$10</b>	<b>\$290</b>	<b>\$550</b>	

Cost Savings Based on:

\$/mcf \$3.97  
 \$/Gal \$0.62  
 \$/kWh \$0.032  
 \$/kW \$96.28  
 \$/mh \$27.50



LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 6800

ANALYSIS DATE: 07-15-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	11640.		
B. SIOH	\$	640.		
C. DESIGN COST	\$	700.		
D. TOTAL COST (1A+1B+1C)	\$	12980.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		12980.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	1.	\$ 8.	8.18	\$ 69.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	146.	\$ 563.	9.51	\$ 5353.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 290.	8.07	\$ 2340.
N. TOTAL		147.	\$ 861.		\$ 7762.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	550.
(1) DISCOUNT FACTOR (TABLE A)	8.07		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	4439.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 4439.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 1411.

5. SIMPLE PAYBACK PERIOD (1G/4) 9.20 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 12201.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .94$   
 (IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 7100 - CHAPEL CENTER FACILITY

**Existing.** In Building 7100, there are seven (7) points currently connected to the existing EMCS, three (3) temperature monitoring (space temperature and dual temperature water supply and return temperature) and four (4) start/stop points (2 pumps, chiller, and boiler). These points are monitoring only points. Two pipe unit ventilators heat and cool all spaces. A gas hot water boiler and a 120 ton air cooled chiller provide hot and chilled water.

**Proposed.** Building 7100 is heated and cooled by fan coil units and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2F for building envelope and equipment. Table 7100-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Hot Water Boiler	5	1	4	2	12		
Air Cooled Chiller	7		4	4	15		Dual temperature pump control included under the hot water boiler
						SFP	
<b>TOTALS</b>	12	1	8	6	27	1	

**TABLE 7100-1**

## Mechanical Systems Controlled By UMCS

**Construction****Cost.**

The estimated cost to install the UMCS control points in Building 7100 is **\$37,340**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$33,490
SIOH	\$ 1,840
Design	<u>\$ 2,010</u>
TOTAL	\$37,340

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$4,180**. Refer to Attachment 8.2F for ESA program output. Table 7100-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	100.2 mmBtu (29,344 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$1,940 ÷ 100.2 mmBtu)
Gas Energy Saved	=	756.3 mmBtu (733.6 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$2,910 ÷ 756.3 mmBtu)
Construction \$	=	\$33,490
SIOH \$	=	\$1,840

Design \$ = \$2,010

Maintenance \$ = \$330 & \$860

Saving to Investment Ratio (SIR)	<b>1.21</b>
Simple Payback (Years)	<b>7.40</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 7100 - CHAPEL CENTER FACILITY  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 7100-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	72.8			21,340		4	\$790
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	614.7	586.3		2,993		4	\$2,540
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	151.9	147.3				4	\$690
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	17.1			5,011			\$160
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
	0.0						\$0
<b>TOTALS</b>	<b>856.5</b>	<b>733.6</b>	<b>0</b>	<b>29,344</b>	<b>0.0</b>	<b>12</b>	<b>\$4,180</b>
		<b>\$2,910</b>	<b>\$0</b>	<b>\$940</b>	<b>\$0</b>	<b>\$330</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE2

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 7100

ANALYSIS DATE: 07-11-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	33490.		
B. SIOH	\$	1840.		
C. DESIGN COST	\$	2010.		
D. TOTAL COST (1A+1B+1C)	\$	37340.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$		0.	
F. PUBLIC UTILITY COMPANY REBATE	\$		0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$			37340.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	100.	\$ 942.	8.18	\$ 7705.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	756.	\$ 2912.	9.51	\$ 27691.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		857.	\$ 3854.		\$ 35395.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		
(1) DISCOUNT FACTOR (TABLE A)	8.07	\$ 1190.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 9603.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) / COST(-) (3A2+3Bd4) \$ 9603.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 5044.

5. SIMPLE PAYBACK PERIOD (1G/4) 7.40 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 44999.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  1.21  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 6.06 %

## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 8452 - RECREATION CENTER

### Existing.

In Building 8452, there are twenty-three (23) points currently connected to the existing EMCS, twelve (12) temperature monitoring (twelve (12) air temperature) and eleven (11) start/stop points (2 pumps, 4 AHU's, 4 condensing units, and 1 air compressor). The only EMCS control to this building is occupied/unoccupied scheduling. Two AHU's heat and cool the gym with a hot water and a DX coil with an outdoor condenser. The lobby/office and snack bar areas are each cooled by an AHU with a hot water and a DX coil with an outdoor condenser. Steam is supplied from Central Plant, Building 8481, to a steam to hot water converter for building heating.

### Proposed.

Building 8452 is heated and cooled by packaged air handling units and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2G for building envelope and equipment. Table 8452-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

### Point List.

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Package AHU(4 total)	16	8	16	12	52		
Steam-HW Convertor	5	1		1	7		
Outdoor Air Temp.	2				2		
Lighting				4	4		
						RTU	
<b>TOTALS</b>	<b>23</b>	<b>9</b>	<b>16</b>	<b>17</b>	<b>65</b>	<b>1</b>	



**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 8452 - RECREATION CENTER  
UMCS STRATEGIES  
TABLE 8452-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	AHU-1	AHU-2	AHU-3	AHU-4	S-W Conv Lighting
Scheduled Start/Stop					
Optimum Start/Stop					
Duty Cycling					
Demand Limiting	X	X	X	X	
Day/Night Setback	X	X	X	X	X
Economizer (Dry Bulb)	X	X	X		
Ventilation and Recirculation	X	X	X	X	
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset					X
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting					
Lighting Control					X

**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 8452 is **\$60,200**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$53,990
SIOH	\$ 2,970
Design	<u>\$ 3,240</u>
TOTAL	\$60,200

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$7,770**. Refer to Attachment 8.2G for ESA program output. Table 8452-2 shows the individual strategy savings.

This building is heated by steam which is supplied by the Boiler Plant, Building 8481. The heating savings shown are based on boiler natural gas savings and an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses to and from the building. The boilers are dual fuel with natural gas being the primary fuel; therefore savings cost will be obtained using natural gas as the fuel. •

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved = 202.3 mmBtu  
(59,282 kWh x 3,413 Btu/kWh ÷  
1,000,000 Btu/mmBtu)

\$/mmBtu-Electric = \$9.40/mmBtu  
(\$1,900 ÷ 202.3 mmBtu)

Yearly Electric  
Demand Saved = 2.4 kW

$$\begin{aligned} \text{Gas Energy Saved} &= 1,322.4 \text{ mmBtu} \\ &= (1,282.6 \text{ mcf} \times 1,031,000 \text{ Btu/mcf} \\ &\quad \div 1,000,000 \text{ Btu/mmBtu}) \end{aligned}$$

$$\begin{aligned} \$/\text{mmBtu} - \text{Gas} &= \$3.80/\text{mmBtu} \\ &= (\$5,090 \div 1,322.4 \text{ mmBtu}) \end{aligned}$$

$$\text{Construction \$} = \$53,990$$

$$\text{SIOH \$} = \$2,970$$

$$\text{Design \$} = \$3,240$$

$$\text{Maintenance \$} = \$550 \text{ \& } \$2,830$$

Saving to Investment Ratio (SIR)	<b>1.55</b>
Simple Payback (Years)	<b>5.68</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 8452 - RECREATION CENTER  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 8452-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0				2.4		\$230
Day/Night Setback	1,036.7	998.6		2,082			\$4,030
Economizer (Dry Bulb)	0.0					8	\$220
Ventilation and Recirculation	121.3	117.7				8	\$690
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	171.5	166.3				4	\$770
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	195.2			57,200			\$1,830
	0.0						\$0
<b>TOTALS</b>	<b>1,524.7</b>	<b>1,282.6</b>	<b>0</b>	<b>59,282</b>	<b>2.4</b>	<b>20</b>	<b>\$7,770</b>
		<b>\$5,090</b>	<b>\$0</b>	<b>\$1,900</b>	<b>\$230</b>	<b>\$550</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 8452

ANALYSIS DATE: 07-25-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	53990.		
B. SIOH	\$	2970.		
C. DESIGN COST	\$	3240.		
D. TOTAL COST (1A+1B+1C)	\$	60200.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)			\$	60200.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	202.	\$ 1902.	8.18	\$ 15555.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	1322.	\$ 5091.	9.51	\$ 48418.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 230.	8.07	\$ 1856.
N. TOTAL		1525.	\$ 7223.		\$ 65829.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	3380.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	27277.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 27277.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 10603.

5. SIMPLE PAYBACK PERIOD (1G/4) 5.68 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 93106.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 1.55  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 8.74 %

## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 8465 - POST CHAPEL

#### Existing.

In Building 8465, there are seven (7) points currently connected to the existing EMCS, four (4) temperature monitoring (space temperature, supply air temperature, and dual temperature water supply and return temperature) and three (3) start/stop points (pump, AHU, and compressor). These points are monitoring only points. An AHU with chilled water coil and steam coil conditions the chapel and two-pipe unit vents condition office and classrooms. Water cooled 40 ton chiller provides chilled water and a steam to hot water converter provides hot water.

#### Proposed.

The Chapel in Building 8465 is heated and cooled by an air handling unit and the office and classrooms are heated and cooled by fan coil units. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2G for building envelope and equipment. Table 8465-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

#### Point List.

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
AHU	4		1	2	7		100% outdoor air unit
Steam HW Convertor	5	1		1	7		Dual temperature pump included with chiller
Water Cooled Chiller	12	2	3	5	22		
						SFP	
TOTALS	21	3	4	8	36	1	

**TABLE 8465-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	AHU-1	S-W Conv	Chiller		
Scheduled Start/Stop					
Optimum Start/Stop					
Duty Cycling	X				
Demand Limiting	X				
Day/Night Setback	X	X			
Economizer (Dry Bulb)	X				
Ventilation and Recirculation	X				
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset		X			
Chiller Selection					
Chilled Water Temp. Reset			X		
Chiller Demand Limiting					
Lighting Control					
Condenser Water Temp. Reset			X		

## **Construction**

### **Cost.**

The estimated cost to install the UMCS control points in Building 8465 is **\$44,670**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$40,070
SIOH	\$ 2,200
Design	<u>\$ 2,400</u>
TOTAL	\$44,670

### **Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$1,930**. Refer to Attachment 8.2G for ESA program output. Table 8465-2 shows the individual strategy savings.

This building is heated by steam which is supplied by the Boiler Plant, Building 8481. The heating savings shown are based on boiler natural gas savings and an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses to and from the building. The boilers are dual fuel with natural gas being the primary fuel; therefore savings cost will be obtained using natural gas as the fuel.

### **Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### **LCCID Inputs**

$$\begin{aligned} \text{Electric Energy Saved} &= 29.3 \text{ mmBtu} \\ &= (8,577 \text{ kWh} \times 3,413 \text{ Btu/kWh} \div \\ &1,000,000 \text{ Btu/mmBtu}) \end{aligned}$$

$$\begin{aligned} \$/\text{mmBtu-Electric} &= \$9.20/\text{mmBtu} \\ &= (\$270 \div 29.3 \text{ mmBtu}) \end{aligned}$$

$$\begin{aligned} \text{Yearly Electric} \\ \text{Demand Saved} &= 0.4 \text{ kW} \end{aligned}$$



$$\begin{aligned} \text{Gas Energy Saved} &= 335.1 \text{ mmBtu} \\ & (325 \text{ mcf} \times 1,031,000 \text{ Btu/mcf} \div \\ & 1,000,000 \text{ Btu/mmBtu}) \end{aligned}$$

$$\begin{aligned} \$/\text{mmBtu} - \text{Gas} &= \$3.80/\text{mmBtu} \\ & (\$1,290 \div 335.1 \text{ mmBtu}) \end{aligned}$$

$$\text{Construction \$} = \$40,070$$

$$\text{SIOH \$} = \$2,200$$

$$\text{Design \$} = \$2,400$$

$$\text{Maintenance \$} = \$330 \text{ \& } \$860$$

Saving to Investment Ratio (SIR)	<b>0.55</b>
Simple Payback (Years)	<b>15.98</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 8465 - POST CHAPEL  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 8465-2**

UMCS Strategy	Energy Savings Summary					
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)
Scheduled Start/Stop	0.0					
Optimum Start/Stop	0.0					
Duty Cycling	4.8			1,397		
Demand Limiting	0.0				0.4	
Day/Night Setback	228.5	220.7		295		4
Economizer (Dry Bulb)	0.0					
Ventilation and Recirculation	42.7	41.4				
Hot Deck/Cold Deck Temp. Reset	0.0					
Steam Boiler Selection	0.0					
Hot Water Boiler Selection	0.0					
Hot Water Outside Air Reset	64.6	62.7				4
Chiller Selection	0.0					
Chilled Water Temp. Reset	7.1			2,088		4
Chiller Demand Limiting	0.0					
Lighting Control	0.0					
Condenser Water Temp. Reset	16.4			4,797		
<b>TOTALS</b>	<b>364</b>	<b>325</b>	<b>0</b>	<b>8,577</b>	<b>0.4</b>	<b>12</b>
		<b>\$1,290</b>	<b>\$0</b>	<b>\$270</b>	<b>\$40</b>	<b>\$330</b>

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      REGION NOS. 3 CENSUS: 3

INSTALLATION & LOCATION: FORT MEADE

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 8465

ANALYSIS DATE: 07-15-96      ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	40070.		
B. SIOH	\$	2200.		
C. DESIGN COST	\$	2400.		
D. TOTAL COST (1A+1B+1C)	\$	44670.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		\$	44670.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	29.	\$ 275.	8.18	\$ 2253.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	335.	\$ 1290.	9.51	\$ 12269.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 40.	8.07	\$ 323.
N. TOTAL		364.	\$ 1606.		\$ 14845.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	1190.
(1) DISCOUNT FACTOR (TABLE A)	8.07		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	9603.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
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d. TOTAL	\$	0.		0.
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C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4)	\$	9603.
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4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$	\$	2796.
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5. SIMPLE PAYBACK PERIOD (1G/4)	15.98 YEARS
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6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	\$	24448.
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7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) =	.55
(IF < 1 PROJECT DOES NOT QUALIFY)	

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):	N/A
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## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 8472 - DENTAL CLINIC

### Existing.

In Building 8472, there are eight (8) points currently connected to the existing EMCS, five (5) temperature monitoring (space temperature, return and mixed air temperature, and hot and cold deck temperatures) and three (3) start/stop points (chiller, pump, and AHU). Those points are monitoring only points. A multi-zone AHU with steam hot deck and chilled water cold deck coils condition the building. A 60 ton air cooled chiller provides chilled water.

### Proposed.

Building 8472 is heated and cooled by a multi-zone air handling unit and unit ventilators. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2G for building envelope and equipment. Table 8472-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

### Point List.

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Multi-zone AHU	6	2	1	2	11		100% outdoor air unit
Air Cooled Chiller	6	1	3	2	12		
Steam HV Convertor	5	1		1	7		
						SFP	
<b>TOTALS</b>	<b>17</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>30</b>	<b>1</b>	

**TABLE 8472-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	AHU-1	Chiller	S-W Conv (Unit Vents)		
Scheduled Start/Stop		X			
Optimum Start/Stop		X			
Duty Cycling					
Demand Limiting					
Day/Night Setback	X		X		
Economizer (Dry Bulb)					
Ventilation and Recirculation	X				
Hot Deck/Cold Deck Temp. Reset	X				
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset			X		
Chiller Selection					
Chilled Water Temp. Reset		X			
Chiller Demand Limiting					
Lighting Control					

## **Construction**

### **Cost.**

The estimated cost to install the UMCS control points in Building 8472 is **\$32,630**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$29,260
SIOH	\$ 1,610
Design	\$ 1,760
TOTAL	\$32,630

### **Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$2,160**. Refer to Attachment 8.2G for ESA program output. Table 8472-2 shows the individual strategy savings.

This building is heated by steam which is supplied by the Boiler Plant, Building 8481. The heating savings shown are based on boiler natural gas savings and an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses to and from the building. The boilers are dual fuel with natural gas being the primary fuel; therefore savings cost will be obtained using natural gas as the fuel.

### **Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### **LCCID Inputs**

Electric Energy Saved	=	37.9 mmBtu (11,118 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.50/mmBtu (\$360 ÷ 37.9 mmBtu)
Gas Energy Saved	=	381.4 mmBtu (369.9 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)

\$/mmBtu - Gas = \$3.90/mmBtu  
(\$1,470 ÷ 381.4 mmBtu)

Construction \$ = \$29,260

SIOH \$ = \$1,610

Design \$ = \$1,760

Maintenance \$ = \$330 & \$980

Saving to Investment Ratio (SIR)	<b>0.84</b>
Simple Payback (Years)	<b>10.41</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 8472 - DENTAL CLINIC  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 8472-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	10.7			3,140			\$100
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	149.1	143.7		282		4	\$690
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	102.6	99.5					\$410
Hot Deck/Cold Deck Temp. Reset	127.3	108.8		4,439		4	\$680
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	18.5	17.9					\$70
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	11.1			3,257		4	\$210
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
	0.0						\$0
<b>TOTALS</b>	<b>419.3</b>	<b>369.9</b>	<b>0</b>	<b>11,118</b>	<b>0.0</b>	<b>12</b>	<b>\$2,160</b>
		<b>\$1,470</b>	<b>\$0</b>	<b>\$360</b>	<b>\$0</b>	<b>\$330</b>	

Cost Savings Based on:

\$/mcf \$3.97  
 \$/Gal \$0.62  
 \$/kWh \$0.032  
 \$/kW \$96.28  
 \$/mh \$27.50



LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE4

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 8472

ANALYSIS DATE: 07-11-96      ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	29260.		
B. SIOH	\$	1610.		
C. DESIGN COST	\$	1760.		
D. TOTAL COST (1A+1B+1C)	\$	32630.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		32630.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	38.	\$ 356.	8.18	\$ 2914.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	382.	\$ 1469.	9.51	\$ 13968.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		419.	\$ 1825.		\$ 16882.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 1310.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 10572.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+) COST(-) (4)
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d. TOTAL	\$ 0.			0.
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C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) / COST(-) (3A2+3Bd4)	\$ 10572.
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4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$	\$ 3135.
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5. SIMPLE PAYBACK PERIOD (1G/4)	10.41 YEARS
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6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	\$ 27454.
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7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) =	.84
(IF < 1 PROJECT DOES NOT QUALIFY)	

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):	N/A
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## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 8476 - BATTALION HEADQUARTERS BUILDING

**Existing.** In Building 8476, there are four (4) points currently connected to the existing EMCS, two (2) temperature monitoring (high and low space temperature) and two (2) start/stop points (AHU and condensing unit). These points are monitoring only points. An AHU with DX coil and steam coil heats and cools building. A 15 ton air cooled condenser is located outside.

**Proposed.** Building 8476 is heated and cooled by a single air handling unit and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2G for building envelope and equipment. Table 8476-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
AHU	5		3	3	11		
Lighting				1	1		
						UPC	
TOTALS	5	0	3	4	12	1	

#### Construction

**Cost.** The estimated cost to install the UMCS control points in Building 8476 is **\$9,690**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$8,690
SIOH	\$ 480
Design	<u>\$ 520</u>
TOTAL	\$9,690

Entech Engineering, Inc.

**TABLE 8476-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS						
	AHU-1	Lighting					
Scheduled Start/Stop							
Optimum Start/Stop							
Duty Cycling							
Demand Limiting							
Day/Night Setback	X						
Economizer (Dry Bulb)	X						
Ventilation and Recirculation	X						
Hot Deck/Cold Deck Temp. Reset							
Steam Boiler Selection							
Hot Water Boiler Selection							
Hot Water Outside Air Reset							
Chiller Selection							
Chilled Water Temp. Reset							
Chiller Demand Limiting							
Lighting Control		X					

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$1,010**. Refer to Attachment 8.2G for ESA program output. Table 8476-2 shows the individual strategy savings.

This building is heated by steam which is supplied by the Boiler Plant, Building 8481. The heating savings shown are based on boiler natural gas savings and an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses to and from the building. The boilers are dual fuel with natural gas being the primary fuel; therefore savings costs will be obtained using natural gas as the fuel.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	64.5 mmBtu (18,884 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.30/mmBtu (\$600 ÷ 64.5 mmBtu)
Gas Energy Saved	=	45.4 mmBtu (44 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$4.00/mmBtu (\$180 ÷ 45.4 mmBtu)
Construction \$	=	\$8,690
SIOH \$	=	\$480
Design \$	=	\$520

Maintenance \$ = \$220

Saving to Investment Ratio (SIR)	<b>0.87</b>
Simple Payback (Years)	<b>9.68</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 8476 - BATTALION HEADQUARTERS BUILDING  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 8476-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	4.0			1,177		4	\$150
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	39.8	37.8		235		4	\$270
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	6.8	6.6					\$30
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	59.6			17,472			\$560
	0.0						\$0
<b>TOTALS</b>	<b>110.2</b>	<b>44.4</b>	<b>0</b>	<b>18,884</b>	<b>0.0</b>	<b>8</b>	<b>\$1,010</b>

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID    FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS.    3    CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 8476

ANALYSIS DATE: 07-25-96    ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	8690.	
B. SIOH	\$	480.	
C. DESIGN COST	\$	520.	
D. TOTAL COST (1A+1B+1C)	\$	9690.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		9690.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	65.	\$ 606.	8.18	\$ 4960.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	45.	\$ 175.	9.51	\$ 1662.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		110.	\$ 781.		\$ 6622.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	220.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	1775.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 1775.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 1001.

5. SIMPLE PAYBACK PERIOD (1G/4) 9.68 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 8397.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) = .87$   
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 2.62 %

## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 8477 - BATTALION HEADQUARTERS BUILDING

- Existing.** Building 8477 is not currently connected to the existing EMCS. An AHU with DX coil and steam coil heats and cools building. A 15 ton air cooled condenser is located outside.
- Proposed.** Building 8477 is heated and cooled by a single air handling unit and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2G for building envelope and equipment. Table 8477-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.
- Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
AHU	5		3	3	11		
Lighting				1	1		
						SFP	
<b>TOTALS</b>	<b>5</b>	<b>0</b>	<b>3</b>	<b>4</b>	<b>12</b>	<b>1</b>	

**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 8477 is **\$12,990**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$11,650
SIOH	\$ 640
Design	\$ 700
<b>TOTAL</b>	<b>\$12,990</b>



## TABLE 8477-1

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	AHU-1	Lighting			
Scheduled Start/Stop					
Optimum Start/Stop					
Duty Cycling					
Demand Limiting					
Day/Night Setback	X				
Economizer (Dry Bulb)	X				
Ventilation and Recirculation	X				
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset					
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting		X			
Lighting Control					

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$1,010**. Refer to Attachment 8.2G for ESA program output. Table 8477-2 shows the individual strategy savings.

This building is heated by steam which is supplied by the Boiler Plant, Building 8481. The heating savings shown are based on boiler natural gas savings and an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses to and from the building. The boilers are dual fuel with natural gas being the primary fuel; therefore savings costs will be obtained using natural gas as the fuel.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	64.5 mmBtu (18,884 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.30/mmBtu (\$600 ÷ 64.5 mmBtu)
Gas Energy Saved	=	45.4 mmBtu (44 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$4.00/mmBtu (\$180 ÷ 45.4 mmBtu)
Construction \$	=	\$11,650
SIOH \$	=	\$640
Design \$	=	\$700

Maintenance \$ = \$220 & \$500

Saving to Investment Ratio (SIR)	<b>0.96</b>
Simple Payback (Years)	<b>8.65</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 8477 - BATTALION HEADQUARTERS BUILDING  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 8477-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	4.0			1,177		4	\$150
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	39.8	37.8		235		4	\$270
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	6.8	6.6					\$30
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	59.6			17,472			\$560
	0.0						\$0
<b>TOTALS</b>	<b>110.2</b>	<b>44.4</b>	<b>0</b>	<b>18,884</b>	<b>0.0</b>	<b>8</b>	<b>\$1,010</b>
		<b>\$180</b>	<b>\$0</b>	<b>\$600</b>	<b>\$0</b>	<b>\$220</b>	

Cost Savings Based on:

\$/mcf \$3.97  
 \$/Gal \$0.62  
 \$/kWh \$0.032  
 \$/kW \$96.28  
 \$/mh \$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE4

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID    FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS.    3    CENSUS:    3

PROJECT NO. & TITLE: 4130.07    UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 8477

ANALYSIS DATE:    07-25-96    ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	11650.	
B. SIOH	\$	640.	
C. DESIGN COST	\$	700.	
D. TOTAL COST (1A+1B+1C)	\$	12990.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	12990.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	65.	\$ 606.	8.18	\$ 4960.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	45.	\$ 175.	9.51	\$ 1662.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		110.	\$ 781.		\$ 6622.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 720.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 5810.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) / COST(-) (3A2+3Bd4) \$ 5810.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 1501.

5. SIMPLE PAYBACK PERIOD (1G/4) 8.65 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 12432.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = .96  
 (IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

**BUILDING BY BUILDING UMCS ANALYSIS**  
**BUILDINGS 8478, 8479, 8544, 8545, 8605, 8607, 8609, 8610 & 8611 - UEPH**

**Existing.**

In Buildings 8479, 8544, 8607, 8609, and 8611, there are five (5) points currently connected from each building to the existing EMCS, one (1) temperature monitoring (dual temperature water supply temperature) and four (4) start/stop points (chiller, dual temperature pump, chilled water pump, and fan coil units). In Buildings 8478, 8545, 8605, and 8610, there are eleven (11) points currently connected from each building to the existing EMCS, five temperature monitoring points (dual temperature water supply and 4 air temperature) and six (6) start/stop points (3 pumps, 2 AHUs, and fan coil units). The points in all residence buildings are only used for monitoring.

All nine buildings have similar heating and air conditioning systems. Rooms are conditioned by two pipe ceiling fan coils in each room supplied with outdoor air from the hallway. Outdoor air is provided by a 100% outdoor air unit located in the basement. Hot water is provided from a converter with steam supplied from the steam plant in Building 8481. Chilled water is provided by a 50 ton air cooled chiller. A rooftop packaged AHU serves the front office/day room/ mess hall areas.

**Proposed.**

These buildings are heated and cooled by fan coil units and only the ESA program was used to calculate UMCS Annual Energy Savings. All nine buildings have similar square footage and mechanical systems and have been considered to have equivalent savings. The ESA program was run for Building 8478 and multiplied by nine for a total energy savings. Refer to Attachment 8.2G for building envelope and equipment. Table 8478-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted. The points for each piece of equipment are for one building; the totals are for all nine buildings combined.

**TABLE 8478-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	Chiller	Rooftop Unit	S-W Conv		
Scheduled Start/Stop					
Optimum Start/Stop					
Duty Cycling					
Demand Limiting					
Day/Night Setback		X			
Economizer (Dry Bulb)		X			
Ventilation and Recirculation		X			
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset			X		
Chiller Selection					
Chilled Water Temp. Reset	X				
Chiller Demand Limiting					
Lighting Control					

	AI	AO	DI	DO	Bldg	Total	Panel	Remarks
Air Cooled Chiller	6	1	3	2	9	108		
Steam HW Convertors	5	1		1	9	63		
Roof top Day Room Unit	3			1	9	36		
							SFP (1) RTU(8)	
Building's	9	9	9	9				
TOTALS	126	18	27	36		207	9	

**Construction Cost.**

The estimated cost to install the 171 UMCS control points in all the buildings is **\$248,630**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$222,990
SIOH	\$ 12,260
Design	<u>\$ 13,380</u>
TOTAL	\$248,630

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$20,680**. Refer to Attachment 8.2G for ESA program output. Table 8478-2 shows the individual strategy savings.

These buildings are heated by steam which is supplied by the Boiler Plant, Building 8481. The heating savings shown are based on boiler natural gas savings and an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses to and from the building. The boilers are dual fuel with natural gas being the primary fuel; therefore savings costs will be obtained using natural gas as the fuel.



**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	90.4 mmBtu (26,478 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$850 ÷ 90.4 mmBtu)
Gas Energy Saved	=	4,379.7 mmBtu (4,248 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$16,860 ÷ 4,379.7 mmBtu)
Construction \$	=	\$222,990
SIOH \$	=	\$12,260
Design \$	=	\$13,380
Maintenance \$	=	\$2,970 & \$8,260

Saving to Investment Ratio (SIR)	<b>1.04</b>
Simple Payback (Years)	<b>8.59</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 8478 - UEPH  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 8478-2**

UMCS Strategy	Energy Savings Summary					
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)
Scheduled Start/Stop	0.0					
Optimum Start/Stop	0.0					
Duty Cycling	0.0					
Demand Limiting	0.0					
Day/Night Setback	398.6	379.8		2,052		36
Economizer (Dry Bulb)	0.0					
Ventilation and Recirculation	0.0					
Hot Deck/Cold Deck Temp. Reset	0.0					
Steam Boiler Selection	0.0					
Hot Water Boiler Selection	0.0					
Hot Water Outside Air Reset	3,988.1	3,868.2				36
Chiller Selection	0.0					
Chilled Water Temp. Reset	83.4			24,426		36
Chiller Demand Limiting	0.0					
Lighting Control	0.0					
TOTALS	4,470.1	4,248.0	0	26,478	0.0	108
		\$16,860	\$0	\$850	\$0	\$2,970
						\$20,680

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 8478

ANALYSIS DATE: 07-11-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	222990.	
B. SIOH	\$	12260.	
C. DESIGN COST	\$	13380.	
D. TOTAL COST (1A+1B+1C)	\$	248630.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$	248630.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	90.	\$ 850.	8.18	\$ 6951.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	4380.	\$ 16862.	9.51	\$ 160356.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		4470.	\$ 17712.		\$ 167307.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 11230.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 90626.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
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d. TOTAL	\$ 0.			0.
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C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)	\$ 90626.
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4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$	\$ 28942.
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5. SIMPLE PAYBACK PERIOD (1G/4)	8.59 YEARS
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6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	\$ 257933.
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7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)=	1.04
(IF < 1 PROJECT DOES NOT QUALIFY)	

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):	N/A
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## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 8481 - BOILER PLANT

- Existing.** Building 8481 is not currently connected to the existing EMCS. Two 700 BHP boilers and one 175 BHP boiler supply 70 psi steam to 22 buildings.
- Proposed.** Building 8481 is a steam boiler plant which provides steam to approximately 22 buildings. This includes many buildings which are part of this study. The steam boiler selection strategy is the only applicable strategy for this building. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2G for boiler equipment schedule. Table 8481-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.
- Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Boiler #1	9		2	1	12		
Boiler #2	9		2	1	12		
Boiler #3	4		1	1	6		This boiler is utilized to handle the summer steam load only. Only boiler status points are included.
Common Points	1		2	1	3		
						RTU	
TOTALS	23	0	7	3	33	2	

**TABLE 8481-1**

[illegible]

**Construction****Cost.**

The estimated cost to install the UMCS control points in Building 8481 is **\$246,720**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$221,270
SIOH	\$ 12,170
Design	<u>\$ 13,280</u>
TOTAL	\$246,720

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$ 3,140**. Refer to Attachment 8.2G for ESA program output. Table 8481-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Gas Energy Saved	=	729.9 mmBtu (708 mcf x 1,031,100 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.80/mmBtu (\$2,810 ÷ 729.9 mmBtu)
Construction \$	=	\$221,270
SIOH \$	=	\$12,170
Design \$	=	\$13,280
Maintenance \$	=	\$330

Saving to Investment Ratio (SIR)	<b>0.12</b>
Simple Payback (Years)	<b>78.47</b>

**Discussion.**

The SIR for this building is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 8481 - BOILER PLANT  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 8481-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	0.0						\$0
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	729.9	708.0				12	\$3,140
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
	0.0						\$0
<b>TOTALS</b>	<b>729.9</b>	<b>708.0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>\$3,140</b>
		<b>\$2,810</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$330</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50



LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID    FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS.    3    CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 8481

ANALYSIS DATE: 07-11-96    ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	221270.	
B. SIOH	\$	12170.	
C. DESIGN COST	\$	13280.	
D. TOTAL COST (1A+1B+1C)	\$	246720.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	300.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		246420.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	0.	\$ 0.	8.18	\$ 0.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	730.	\$ 2810.	9.51	\$ 26724.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		730.	\$ 2810.		\$ 26724.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	330.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	2663.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 2663.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 3140.

5. SIMPLE PAYBACK PERIOD (1G/4) 78.47 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 29387.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  .12  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): -15.84 %

**BUILDING BY BUILDING UMCS ANALYSIS**  
**BUILDING 8485 and 8486 - ORG VEHICLE MAINTENANCE SHOP**

**Existing.** Buildings 8485 and 8486 are not currently connected to the existing EMCS. An oil fired hot air furnace heats the building and there is no cooling.

**Proposed.** Buildings 8485 and 8486 are each heated only by an oil fired furnace and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2G for building envelope and equipment. Table 8485-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Oil Fired Furnace 8485	2		1	1	4		
Oil Fired Furnace 8486	2		1	1	4		
						UC	
TOTALS	4	0	2	2	8	1	

**TABLE 8485-1**

# Mechanical Systems Controlled By UMCS

**Construction****Cost.**

The estimated cost to install the UMCS control points in Buildings 8485 and 8486 is **\$3,770**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$3,380
SIOH	\$ 190
Design	<u>\$ 200</u>
TOTAL	\$3,770

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$1,240**. Refer to Attachment 8.2G for ESA program output. Table 8485-2 shows the individual strategy savings.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Oil Energy Saved	=	227.5 mmBtu (1,640 gal x 138,700 Btu/gal ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Oil	=	\$4.50/mmBtu (\$1,020 ÷ 227.5 mmBtu)
Construction \$	=	\$3,380
SIOH \$	=	\$190
Design \$	=	\$200
Maintenance \$	=	\$220

Saving to Investment Ratio (SIR)	<b>19.34</b>
Simple Payback (Years)	<b>0.5</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

## TABLE 8485-2

Cost Savings Based on:	\$/mcf	\$/Gal	\$/kWh	\$/kW	\$/mh
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LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 8485

ANALYSIS DATE: 07-11-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	3380.		
B. SIOH	\$	190.		
C. DESIGN COST	\$	200.		
D. TOTAL COST (1A+1B+1C)	\$	3770.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		3770.	

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	0.	\$ 0.	8.18	\$ 0.
B. DIST	\$ 4.50	1640.	\$ 7380.	9.64	\$ 71143.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	0.	\$ 0.	9.51	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		1640.	\$ 7380.		\$ 71143.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 220.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 1775.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+) / COST(-) (4)
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d. TOTAL	\$ 0.			0.
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C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) / COST(-) (3A2+3Bd4)	\$ 1775.
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4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$	\$ 7600.
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5. SIMPLE PAYBACK PERIOD (1G/4)	.50 YEARS
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6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	\$ 72919.
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7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) =	19.34
(IF < 1 PROJECT DOES NOT QUALIFY)	

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR) :	39.99 %
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## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 8606 - UEPH

**Existing.** In Building 8606, there are twelve (12) points currently connected to the existing EMCS, nine (9) temperature monitoring (3 return air, 3 mixed air and 3 supply air) and three (3) start/stop points (3 AHUs). The points in all residence buildings are only used for monitoring. Rooms are conditioned by two pipe ceiling fan coil units in each room supplied with outdoor air from a 100% outdoor air AHU. Chilled water is provided by a 50 ton air cooled chiller. A rooftop packaged AHU serves the front office/day room /mess hall areas.

**Proposed.** Building 8606 is heated and cooled by fan coil units and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2G for building envelope and equipment. Table 8606-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Air Cooled Chiller	6	1	3	2	12		
Steam HW Convertor	5	1		1	7		
Roof top Day Room Unit	3			1	4		
						SFP	
<b>TOTALS</b>	14	2	3	4	23	1	



**TABLE 8606-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	Chiller	Rooftop Unit	S-W Conv		
Scheduled Start/Stop					
Optimum Start/Stop					
Duty Cycling					
Demand Limiting					
Day/Night Setback		X			
Economizer (Dry Bulb)		X			
Ventilation and Recirculation		X			
Hot Deck/Cold Deck Temp. Reset					
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset			X		
Chiller Selection					
Chilled Water Temp. Reset	X				
Chiller Demand Limiting					
Lighting Control					

## **Construction**

### **Cost.**

The estimated cost to install the UMCS control points in Building 8606 is **\$28,520**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$25,580
SIOH	\$ 1,410
Design	<u>\$ 1,530</u>
TOTAL	\$28,520

### **Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$2,310**. Refer to Attachment 8.2G for ESA program output. Table 8606-2 shows the individual strategy savings.

This building is heated by steam which is supplied by the Boiler Plant, Building 8481. The heating savings shown are based on boiler natural gas savings and an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses to and from the building. The boilers are dual fuel with natural gas being the primary fuel; therefore savings costs will be obtained using natural gas as the fuel.

### **Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### **LCCID Inputs**

Electric Energy Saved	=	10.0 mmBtu (2,942 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.00/mmBtu (\$90 ÷ 10.0 mmBtu)
Gas Energy Saved	=	487.7 mmBtu (473 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)

\$/mmBtu - Gas = \$3.90/mmBtu  
(\$1,880 ÷ 487.7 mmBtu)

Construction \$ = \$25,580

SIOH \$ = \$1,410

Design \$ = \$1,530

Maintenance \$ = \$330 & \$1,350

Saving to Investment Ratio (SIR)	<b>1.13</b>
Simple Payback (Years)	<b>7.81</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 8606 - UEPH  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 8606-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	45.6	43.5		228		4	\$290
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	443.1	429.8				4	\$1,820
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	9.3			2,714		4	\$200
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
	0.0						\$0
<b>TOTALS</b>	<b>498.0</b>	<b>473.3</b>	<b>0</b>	<b>2,942</b>	<b>0.0</b>	<b>12</b>	<b>\$2,310</b>
		<b>\$1,880</b>	<b>\$0</b>	<b>\$90</b>	<b>\$0</b>	<b>\$330</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 8606

ANALYSIS DATE: 07-11-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	25580.		
B. SIOH	\$	1410.		
C. DESIGN COST	\$	1530.		
D. TOTAL COST (1A+1B+1C)	\$	28520.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$		0.	
F. PUBLIC UTILITY COMPANY REBATE	\$		0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)				\$ 28520.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	10.	\$ 94.	8.18	\$ 769.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	488.	\$ 1878.	9.51	\$ 17856.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		498.	\$ 1972.		\$ 18625.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		
(1) DISCOUNT FACTOR (TABLE A)	8.07	\$ 1680.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 13558.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
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d. TOTAL	\$ 0.			0.
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C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)	\$ 13558.
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4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$	\$ 3652.
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5. SIMPLE PAYBACK PERIOD (1G/4)	7.81 YEARS
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6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	\$ 32183.
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7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) =	1.13
(IF < 1 PROJECT DOES NOT QUALIFY)	

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):	N/A
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## **BUILDING BY BUILDING UMCS ANALYSIS BUILDINGS 9801, 9802, 9803 and 9804 - UEPH**

### **Existing.**

Buildings 9801 and 9803 currently have nine (9) points from each building connected to the existing EMCS. Five (5) points are temperature monitoring points (4 air and 1 space temperature) and four (4) start/stop points (AHU, 2 pumps, chiller).

Buildings 9802 and 9804 currently have seven (7) points from each building connected to the existing EMCS. Five (5) points are temperature monitoring points (4 air and 1 space temperature), and two (2) points are start/stop points (AHU and pump).

All existing points in these buildings are monitoring only points.

All four buildings have similar heating and cooling systems. Two pipe ceiling mounted fan coils condition each room. The 100% outdoor air AHU's provide outside ventilation air to each room. Hot water is provided by a steam to water converter with steam supplied from building 9807. Chilled water is provided by two 200 ton chillers. Each chiller serves two buildings. A multi-zone air handling unit conditions the day room and office areas.

### **Proposed.**

These buildings are heated and cooled by fan coil units and only the ESA program was used to calculate UMCS Annual Energy Savings. Buildings 9801 and 9803 have water-cooled centrifugal chillers. The chiller in Building 9801 serves Buildings 9801 and 9802. The chiller in Building 9803 serves Buildings 9803 and 9804. Each of the four (4) buildings has a steam-to-water convertor providing heating for the spaces.

The ESA program was run for Building 9801 and multiplied by four to arrive at a total savings for Buildings 9801, 9802, 9803, and 9804. This was done because all four buildings have similar square footage, floor plans, mechanical systems, and occupancies. The condenser water reset strategy was not applied because of low savings and a high construction cost.

Refer to Attachment 8.2G for building envelope and equipment. Table 9801-1 as follows indicates the UMCS strategies to be applied for energy savings in these buildings. The chiller points apply to Buildings 9801 and 9803 only.

**Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Convertor 9801	5	1		1	7	SFP	
Chiller 9801	12	2	3	5	22		
Convertor 9802	5	1	1	2	9	UPC	
Convertor 9803	5	1		1	7	RTU	
Chiller 9803	12	2	3	5	22		
Converter 9804	5	1	1	2	9	UPC	
TOTALS	44	8	8	16	76	4	

**Construction  
Cost.**

The estimated cost to install the UMCS control points in Buildings 9801, 9802, 9803, and 9804 is **\$102,000**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$ 91,480
SIOH	\$ 5,030
Design	\$ 5,490
TOTAL	\$102,000

## TABLE 9801-1

UMCS Strategy	Mechanical Systems Controlled By UMCS					
	Chiller	S-W Conv				
Scheduled Start/Stop						
Optimum Start/Stop						
Duty Cycling						
Demand Limiting						
Day/Night Setback						
Economizer (Dry Bulb)						
Ventilation and Recirculation						
Hot Deck/Cold Deck Temp. Reset						
Steam Boiler Selection						
Hot Water Boiler Selection						
Hot Water Outside Air Reset		X				
Chiller Selection						
Chilled Water Temp. Reset	X					
Chiller Demand Limiting	X					
Lighting Control						
Condenser Water Temp. Reset						



**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$3,750**. Refer to Attachment 8.2G for ESA program output. Table 9801-2 shows the individual strategy savings.

These buildings are heated by steam which is supplied by the Boiler Plant. The heating savings shown are based on boiler natural gas savings and an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses to and from the building. The boilers are dual fuel with natural gas being the primary fuel; therefore savings costs will be obtained using natural gas as the fuel.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	96.9 mmBtu (28,396 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$910 ÷ 96.9 mmBtu)
Yearly Electric Demand Savings	=	20.0 kW
Gas Energy Saved	=	8.7 mmBtu (8.4 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.50/mmBtu (\$30 ÷ 8.7 mmBtu)
Construction \$	=	\$91,480
SIOH \$	=	\$5,030

Design \$ = \$5,490

Maintenance \$ = \$880 & \$3,940

Saving to Investment Ratio (SIR)	<b>0.61</b>
Simple Payback (Years)	<b>13.26</b>

**Discussion.**

The SIR for these buildings is less than 1.25 and is not recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 9801 - UEPH  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 9801-2**

UMCS Strategy	Energy Savings Summary						Cost Savings
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	0.0						\$0
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	8.7	8.4				16	\$470
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	96.9			28,396		16	\$1,350
Chiller Demand Limiting	0.0				20.0		\$1,930
Lighting Control	0.0						\$0
Condenser Water Reset	0.0						\$0
<b>TOTALS</b>	<b>105.6</b>	<b>8.4</b>	<b>0</b>	<b>28,396</b>	<b>20.0</b>	<b>32</b>	<b>\$3,750</b>

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

	\$30	\$0	\$910	\$1,930	\$880
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Entech Engineering, Inc.

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04-Jun-96

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 9801

ANALYSIS DATE: 07-15-96      ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	91480.	
B. SIOH	\$	5030.	
C. DESIGN COST	\$	5490.	
D. TOTAL COST (1A+1B+1C)	\$	102000.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		102000.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	97.	\$ 911.	8.18	\$ 7451.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	9.	\$ 33.	9.51	\$ 319.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 1930.	8.07	\$ 15575.
N. TOTAL		106.	\$ 2874.		\$ 23344.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 4820.
(1) DISCOUNT FACTOR (TABLE A)	8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 38897.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
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d. TOTAL	\$ 0.			0.
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C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)	\$ 38897.
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4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$	\$ 7694.
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5. SIMPLE PAYBACK PERIOD (1G/4)	13.26 YEARS
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6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	\$ 62242.
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7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) =	.61
(IF < 1 PROJECT DOES NOT QUALIFY)	

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):	N/A
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## **BUILDING BY BUILDING UMCS ANALYSIS**

### **BUILDING 9810 - RECREATION CENTER**

#### **Existing.**

In Building 9810, there are eighteen (18) points currently connected to the existing EMCS, twelve (12) temperature monitoring (12 air temperature) and six (6) start/stop points (AHU-1 through 4, chilled water pump, and chiller). The only control of these points is scheduled start/stop. Two AHU's serve the gym with hot and chilled water coils. The administrative and weight rooms are served by a single AHU with hot and chilled water coils and a return fan. The PX is served by a single AHU with hot and chilled water coils. A steam to water converter and 20 ton air cooled chiller provide hot and chilled water.

#### **Proposed.**

Building 9810 is heated by steam from a central steam plant to a steam-to-hot water convertor. Hot water is pumped to fin tube radiation and hot water coils in (4) single zone air handlers. Cooling is provided by an air-cooled chiller located outside the building. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2G for building envelope and equipment. Table 9810-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

#### **Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

**TABLE 9810-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS					
	AHU 1 & 2	Fin Tube	Air Cooled Chiller	Stm-HW Convertor	H&V Unit	AHU 3 & 4
Scheduled Start/Stop			X		X	X
Optimum Start/Stop			X		X	X
Duty Cycling						
Demand Limiting	X					X
Day/Night Setback	X	X		X		
Economizer (Dry Bulb)	X					X
Ventilation and Recirculation	X				X	X
Hot Deck/Cold Deck Temp. Reset						
Steam Boiler Selection						
Hot Water Boiler Selection						
Hot Water Outside Air Reset				X		
Chiller Selection						
Chilled Water Temp. Reset			X			
Chiller Demand Limiting						
Lighting Control						

	AI	AO	DI	DO	Total	Panel	Remarks
AHU-1	5	3	2	1	11		
AHU-2	5	3	2	1	11		
AHU-3	4		1	2	7		
AHU-4	4		1	2	7		
H&V-1	3		2	2	7		
Fin Tube	1		1	1	3		
Convertor	5	1		1	7		
Chiller	6	1	3	2	12		
						SFP,RTU	
TOTALS	33	8	12	12	65	2	

**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 9810 is **\$59,360**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$53,240
SIOH	\$ 2,930
Design	<u>\$ 3,190</u>
TOTAL	\$59,360

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$7,860**. Refer to Attachment 8.2G for ESA program output. Table 9810-2 shows the individual strategy savings.

This building is heated by steam which is supplied by the Boiler Plant. The heating savings shown are based on boiler natural gas savings and an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses to and from the building. The boilers are dual fuel with natural gas being

the primary fuel; therefore savings costs will be obtained using natural gas as the fuel.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

LCCID Inputs

Electric Energy Saved	=	256.7 mmBtu (28,510 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.40/mmBtu (\$910 ÷ 97.3 mmBtu)
Yearly Electric Demand Saved	=	1.9 kW
Gas Energy Saved	=	1,558.3 mmBtu (1,511.4 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu - Gas	=	\$3.90/mmBtu (\$6,000 ÷ 1,558.3 mmBtu)
Construction \$	=	\$53,240
SIOH \$	=	\$2,930
Design \$	=	\$3,190
Maintenance \$	=	\$770 & \$2,210



Saving to Investment Ratio (SIR)	<b>1.72</b>
Simple Payback (Years)	<b>5.13</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 9810 - RECREATION CENTER  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 9810-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	842.5	736.3		24,420		8	\$3,920
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0				1.9		\$180
Day/Night Setback	713.0	690.6		290		8	\$2,970
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	68.9	66.8				4	\$380
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	18.2	17.7				4	\$180
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	13.0			3,800			\$120
Chiller Demand Limiting	0.0					4	\$110
Lighting Control	0.0						\$0
	0.0						\$0
<b>TOTALS</b>	<b>1,655.6</b>	<b>1,511.4</b>	<b>0</b>	<b>28,510</b>	<b>1.9</b>	<b>28</b>	<b>\$7,860</b>
		<b>\$6,000</b>	<b>\$0</b>	<b>\$910</b>	<b>\$180</b>	<b>\$770</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 9810

ANALYSIS DATE: 07-15-96      ECONOMIC LIFE 10 YEARS      PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	53240.		
B. SIOH	\$	2930.		
C. DESIGN COST	\$	3190.		
D. TOTAL COST (1A+1B+1C)	\$	59360.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		\$	59360.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	257.	\$ 2413.	8.18	\$ 19738.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	1558.	\$ 5999.	9.51	\$ 57055.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 180.	8.07	\$ 1453.
N. TOTAL		1815.	\$ 8592.		\$ 78246.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	2980.
(1) DISCOUNT FACTOR (TABLE A)	8.07		
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	24049.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 24049.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 11572.

5. SIMPLE PAYBACK PERIOD (1G/4) 5.13 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 102294.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  1.72  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 9.92 %

## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 9827 - UEPH

**Existing.**

In Building 9827, there are four (4) points currently connected to the existing EMCS, two (2) temperature monitoring (space temperature and dual temperature water supply temperature) and two (2) start/stop points (dual temperature pump and chiller). These four points are monitoring only points. Two pipe floor mounted fan coil units in each room with outdoor air. Steam to water converter and 100 ton water chiller with a cooling tower provide hot and chilled water.

**Proposed.**

Building 9827 is heated and cooled by fan coil units and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2G for building envelope and equipment. Table 9827-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
					25	SFP	Existing DDC system currently under construction. Add panel to connect to central UMCS.
<b>TOTALS</b>					25	1	

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 9827 - UEPH  
UMCS STRATEGIES  
TABLE 9827-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS			
	Fan Coils	Hot Water Boiler	Chiller	
Scheduled Start/Stop				
Optimum Start/Stop				
Duty Cycling				
Demand Limiting				
Day/Night Setback				
Economizer (Dry Bulb)				
Ventilation and Recirculation				
Hot Deck/Cold Deck Temp. Reset				
Steam Boiler Selection				
Hot Water Boiler Selection				
Hot Water Outside Air Reset		X		
Chiller Selection				
Chilled Water Temp. Reset			X	
Chiller Demand Limiting				
Lighting Control				
Condenser Water Temp. Reset				

**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 9827 is **\$6,590**. The building is currently undergoing renovation, and as part of the renovation a new DDC Energy Management Control System is being installed. The construction cost estimate only includes costs to connect the building EMCS to the new Base UMCS. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$5,910
SIOH	\$ 330
Design	<u>\$ 350</u>
TOTAL	\$6,590

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$1,790**. Refer to Attachment 8.2G for ESA program output. Table 9827-2 shows the individual strategy savings.

This building is heated by steam which is supplied by the Boiler Plant. The heating savings shown are based on boiler natural gas savings and an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses to and from the building. The boilers are dual fuel with natural gas being the primary fuel; therefore savings costs will be obtained using natural gas as the fuel.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

LCCID Inputs

Electric Energy Saved	=	14.3 mmBtu (4,176 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.10/mmBtu (\$130 ÷ 14.3 mmBtu)

$$\begin{aligned} \text{Gas Energy Saved} &= 375.0 \text{ mmBtu} \\ & (363.7 \text{ mcf} \times 1,031,000 \text{ Btu/mcf} \div \\ & 1,000,000 \text{ Btu/mmBtu}) \end{aligned}$$

$$\begin{aligned} \$/\text{mmBtu} - \text{Gas} &= \$3.80/\text{mmBtu} \\ & (\$1,440 \div 375.0 \text{ mmBtu}) \end{aligned}$$

$$\text{Construction \$} = \$5,910$$

$$\text{SIOH \$} = \$330$$

$$\text{Design \$} = \$350$$

$$\text{Maintenance \$} = \$220$$

Saving to Investment Ratio (SIR)	<b>2.52</b>
Simple Payback (Years)	<b>3.66</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 9827 - UEPH  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 9827-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	0.0						\$0
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	0.0						\$0
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	0.0						\$0
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	375.0	363.7				4	\$1,550
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	14.3			4,176		4	\$240
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
TOTALS	389.2	363.7	0	4,176	0.0	8	\$1,790
		\$1,440	\$0	\$130	\$0	\$220	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50



LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 9827

ANALYSIS DATE: 07-11-96      ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	5910.		
B. SIOH	\$	330.		
C. DESIGN COST	\$	350.		
D. TOTAL COST (1A+1B+1C)	\$	6590.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		\$	6590.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	14.	\$ 134.	8.18	\$ 1100.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	375.	\$ 1444.	9.51	\$ 13730.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		389.	\$ 1578.		\$ 14830.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	220.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	1775.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTOR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 1775.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 1798.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.66 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 16605.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  2.52  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 14.18 %

## BUILDING BY BUILDING UMCS ANALYSIS

### BUILDING 9828 - UEPH

**Existing.**

In Building 9828, there are eleven (11) points currently connected to the existing EMCS, five (5) temperature monitoring (four return air temperature and dual temperature water supply temperature) and six (6) start/stop points (Chiller, dual temperature pump and four air handling units). The existing points are used for monitoring only (proof-of-runs on equipment). Two pipe ceiling mounted fan coil units in each room. 100% outdoor air AHU's for each floor, steam to water converter, 180 ton water chiller with cooling tower.

**Proposed.**

Building 9828 is heated and cooled by Fan-coil-units and only the ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2G for building envelop and equipment. Table 9828-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.**

The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
					25	RTU	Existing DDC system currently under construction. Add panel to connect to central UMCS.
<b>TOTALS</b>					25	1	

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 9828 - UEPH  
UMCS STRATEGIES  
TABLE 9828-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS			
	Fan Coils	Hot Water Boiler	Chiller	AHU-1
Scheduled Start/Stop				X
Optimum Start/Stop				
Duty Cycling				
Demand Limiting				
Day/Night Setback				
Economizer (Dry Bulb)				X
Ventilation and Recirculation				X
Hot Deck/Cold Deck Temp. Reset				
Steam Boiler Selection				
Hot Water Boiler Selection				
Hot Water Outside Air Reset		X		
Chiller Selection				
Chilled Water Temp. Reset			X	
Chiller Demand Limiting				
Lighting Control				
Condenser Water Temp. Reset			X	

**Construction  
Cost.**

The estimated cost to install the UMCS control points in Building 9828 is **\$5,890**. The building is currently undergoing renovation, and as part of the renovation a new DDC Energy Management Control System is being installed. The construction cost estimate only includes costs to connect the building EMCS to the new Base UMCS. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$5,280
SIOH	\$ 290
Design	<u>\$ 320</u>
TOTAL	\$5,890

**Savings.**

The total anticipated savings by applying the before mentioned UMCS strategies is **\$3,660**. Refer to Attachment 8.2G for ESA program output. Table 9828-2 shows the individual strategy savings.

This building is heated by steam which is supplied by the Boiler Plant. The heating savings shown are based on boiler natural gas savings and an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses to and from the building. The boilers are dual fuel with natural gas being the primary fuel; therefore savings costs will be obtained using natural gas as the fuel.

**Economics.**

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

**LCCID Inputs**

Electric Energy Saved	=	109.2 mmBtu (32,012 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.30/mmBtu (\$1,020 ÷ 109.2 mmBtu)

$$\begin{aligned} \text{Gas Energy Saved} &= 628.6 \text{ mmBtu} \\ & (609.7 \text{ mcf} \times 1,031,000 \text{ Btu/mcf} \div \\ & 1,000,000 \text{ Btu/mmBtu}) \end{aligned}$$

$$\begin{aligned} \$/\text{mmBtu} - \text{Gas} &= \$3.80/\text{mmBtu} \\ & (\$2,420 \div 628.6 \text{ mmBtu}) \end{aligned}$$

$$\text{Construction \$} = \$5,280$$

$$\text{SIOH \$} = \$290$$

$$\text{Design \$} = \$320$$

$$\text{Maintenance \$} = \$220$$

Saving to Investment Ratio (SIR)	<b>5.63</b>
Simple Payback (Years)	<b>1.61</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 9828 - UEPH  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 9828-2**

UMCS Strategy	Energy Savings Summary						
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	Cost Savings
Scheduled Start/Stop	255.4	223.8		7,225			\$1,120
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	0.0						\$0
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	21.3	20.7					\$80
Hot Deck/Cold Deck Temp. Reset	0.0						\$0
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	376.5	365.2				4	\$1,560
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	25.7			7,517		4	\$350
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
Condenser Water Temp. Reset	58.9			17,270			\$550
<b>TOTALS</b>	<b>737.9</b>	<b>609.7</b>	<b>0</b>	<b>32,012</b>	<b>0.0</b>	<b>8</b>	<b>\$3,660</b>
		<b>\$2,420</b>	<b>\$0</b>	<b>\$1,020</b>	<b>\$0</b>	<b>\$220</b>	

Cost Savings Based on:

\$/mcf \$3.97  
 \$/Gal \$0.62  
 \$/kWh \$0.032  
 \$/kW \$96.28  
 \$/mh \$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: BLDG 9828

ANALYSIS DATE: 07-11-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	5280.		
B. SIOH	\$	290.		
C. DESIGN COST	\$	320.		
D. TOTAL COST (1A+1B+1C)	\$	5890.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.		
F. PUBLIC UTILITY COMPANY REBATE	\$	0.		
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$			5890.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	109.	\$ 1026.	8.18	\$ 8397.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	629.	\$ 2420.	9.51	\$ 23015.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		738.	\$ 3447.		\$ 31412.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	220.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	1775.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
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d. TOTAL	\$	0.		0.
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C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)	\$	1775.
--	----	-------

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$	\$	3667.
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5. SIMPLE PAYBACK PERIOD (1G/4)	1.61 YEARS
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6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)	\$	33187.
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7. SAVINGS TO INVESTMENT RATIO (SIR) = $(6 / 1G) =$	5.63
(IF < 1 PROJECT DOES NOT QUALIFY)	

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):	23.75 %
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## BUILDING BY BUILDING UMCS ANALYSIS BUILDING 9829 - ENLISTED PERSONNEL DINING

**Existing.** Building 9829 is not currently connected to the existing EMCS. Two packaged rooftop units with gas heating serve the dining area. Gas fired and steam heated 100% outdoor air makeup units serve the kitchen.

**Proposed.** Building 9829 is heated and cooled by packaged roof top gas heating/electric cooling multi-zone units. Roof-mounted gas fired make-up air unit supplies the kitchen area along with a second unit with steam heat. The ESA program was used to calculate UMCS Annual Energy Savings. Refer to Attachment 8.2G for building envelope and equipment. Table 9829-1 on the next page indicates the UMCS strategies to be applied for energy savings in this building.

**Point List.** The following table indicates the number of analog and digital points required to meet the listed UMCS strategies. This point list is based on EMCS manual TM5-815-2, January 1991, except as noted.

	AI	AO	DI	DO	Total	Panel	Remarks
Roof top - 1	3			1	4		
Roof top - 2	3			1	4		
MU-1	2		1	1	4		
MU-2	2		1	1	4		
Outdoor Air Temperature	2				2		
						SFP	
<b>TOTALS</b>	12	0	2	4	18	1	



**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 9829 - ENLISTED PERSONEL DINING  
UMCS STRATEGIES  
TABLE 9829-1**

UMCS Strategy	Mechanical Systems Controlled By UMCS				
	Roof-top-1	Roof-top-2	MU-1	MU-2	
Scheduled Start/Stop				X	
Optimum Start/Stop				X	
Duty Cycling					
Demand Limiting					
Day/Night Setback	X	X	X		
Economizer (Dry Bulb)	X	X			
Ventilation and Recirculation	X	X	X	X	
Hot Deck/Cold Deck Temp. Reset	X	X			
Steam Boiler Selection					
Hot Water Boiler Selection					
Hot Water Outside Air Reset					
Chiller Selection					
Chilled Water Temp. Reset					
Chiller Demand Limiting					
Lighting Control					

## Construction

### Cost.

The estimated cost to install the UMCS control points in Building 9829 is **\$11,560**. An itemized cost estimate is included in Section 5.2 and Attachment 8.3.

Construction	\$10,370
SIOH	\$ 570
Design	<u>\$ 620</u>
TOTAL	\$11,560

### Savings.

The total anticipated savings by applying the before mentioned UMCS strategies is **\$7,730**. Refer to Attachment 8.2G for ESA program output. Table 9829-2 shows the individual strategy savings.

MU-1 heats with steam from a central boiler plant, while the two rooftop multi-zone units and the other kitchen unit heat with direct-fired natural gas. The heating savings associated with MU-1 are based on boiler natural gas savings at an overall heat-to-fuel efficiency of 65%. This efficiency accounts for the boiler efficiency and line losses.

### Economics.

Using the LCCID program, the economics for this project are as follows: (reference to attached LCCID output).

#### LCCID Inputs

Electric Energy Saved	=	86 mmBtu (25,154 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
\$/mmBtu-Electric	=	\$9.30/mmBtu (\$800 ÷ 86 mmBtu)
Gas Energy Saved	=	1,684 mmBtu (1,633.1 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)

$$\begin{aligned} \$/\text{mmBtu} - \text{Gas} &= \$4.00/\text{mmBtu} \\ &(\$6,480 \div 1,633 \text{ mmBtu}) \end{aligned}$$

$$\text{Construction \$} = \$10,370$$

$$\text{SIOH \$} = \$570$$

$$\text{Design \$} = \$620$$

$$\text{Maintenance \$} = \$440 \text{ \& } \$250$$

Saving to Investment Ratio (SIR)	<b>6.39</b>
Simple Payback (Years)	<b>1.45</b>

**Discussion.**

The SIR for this building is greater than 1.25 and is recommended to be included in the Base UMCS ECO.

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING 9829 - ENLISTED PERSONNEL DINING  
UMCS STRATEGIES ENERGY SAVINGS  
TABLE 9829-2**

UMCS Strategy	Energy Savings Summary						Cost Savings
	Energy (mmBtu/Yr)	Natural Gas (mcf/Yr)	Fuel Oil (Gal/Yr)	Elec. Usage (kWh/Yr)	Elec. Demand (kW)	Labor Cost (mh/yr)	
Scheduled Start/Stop	1,234.8	1,165.2		9,814		4	\$5,050
Optimum Start/Stop	0.0						\$0
Duty Cycling	0.0						\$0
Demand Limiting	0.0						\$0
Day/Night Setback	82.5	78.2		544		4	\$440
Economizer (Dry Bulb)	0.0						\$0
Ventilation and Recirculation	179.0	173.6				8	\$910
Hot Deck/Cold Deck Temp. Reset	273.3	216.1		14,796			\$1,330
Steam Boiler Selection	0.0						\$0
Hot Water Boiler Selection	0.0						\$0
Hot Water Outside Air Reset	0.0						\$0
Chiller Selection	0.0						\$0
Chilled Water Temp. Reset	0.0						\$0
Chiller Demand Limiting	0.0						\$0
Lighting Control	0.0						\$0
<b>TOTALS</b>	<b>1,769.6</b>	<b>1,633.1</b>	<b>0</b>	<b>25,154</b>	<b>0.0</b>	<b>16</b>	<b>\$7,730</b>
		<b>\$6,480</b>	<b>\$0</b>	<b>\$800</b>	<b>\$0</b>	<b>\$440</b>	

Cost Savings Based on:

\$/mcf	\$3.97
\$/Gal	\$0.62
\$/kWh	\$0.032
\$/kW	\$96.28
\$/mh	\$27.50

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE3

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)      LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE      REGION NOS. 3      CENSUS: 3

PROJECT NO. & TITLE: 4130.07      UMCS FEASIBILITY STUDY

FISCAL YEAR 1996      DISCRETE PORTION NAME: BLDG 9829

ANALYSIS DATE: 07-11-96      ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	10370.		
B. SIOH	\$	570.		
C. DESIGN COST	\$	620.		
D. TOTAL COST (1A+1B+1C)	\$	11560.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$		0.	
F. PUBLIC UTILITY COMPANY REBATE	\$		0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			\$	11560.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU (1)	SAVINGS MBTU/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 9.40	86.	\$ 808.	8.18	\$ 6613.
B. DIST	\$ 4.50	0.	\$ 0.	9.64	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	1684.	\$ 6483.	9.51	\$ 61657.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 0.	8.07	\$ 0.
N. TOTAL		1770.	\$ 7292.		\$ 68270.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)		\$	690.
(1) DISCOUNT FACTOR (TABLE A)		8.07	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	5568.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 5568.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 7982.

5. SIMPLE PAYBACK PERIOD (1G/4) 1.45 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 73838.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  6.39  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 25.31 %

## **6.0 BASE UMCS ENERGY CONSERVATION OPPORTUNITY**

### **6.1 General**

Eighty-three (83) buildings were individually analyzed in Section 5.0. This section incorporates all recommended buildings within an SIR of greater than 1.25 into a single UMCS Energy Conservation Opportunity (ECO) for the base. The format for documenting the base UMCS Energy Conservation Opportunity is as follows:

<i><b>Existing</b></i>	discusses the current base EMCS and the current point count and buildings connected.
<i><b>Proposed</b></i>	outlines the new distributed-process monitoring and control system (UMCS) and reviews each building analysis and recommends buildings to be included in the Base UMCS based on each building's economic analysis.
<i><b>Point List</b></i>	summarizes all recommended building point totals.
<i><b>Construction Cost</b></i>	summarizes recommended building UMCS costs and the system wide costs.
<i><b>Savings</b></i>	summarizes recommended building annual energy savings.
<i><b>Economics</b></i>	states the economic feasibility of the Base UMCS utilizing BLAST's LCCID program. LCCID calculates life cycle costs and additional economics for energy conservation in DoD construction. Using the previous data, the economics of the base UMCS is calculated and shown in this section.
<i><b>Discussion</b></i>	notes additional monetary or operational factors and reviews the economic analysis.

## 6.2 Base UMCS Energy Conservation Opportunity (ECO)

### BASE UMCS ENERGY CONSERVATION OPPORTUNITY

#### Fort George G. Meade

##### *Existing*

The existing base EMCS encompasses seventy-six (76) buildings for a total connected point count of 742. Of the seventy-six (76) buildings on the existing EMCS, twenty-one (21) of those buildings are recommended to be included in the Base UMCS ECO. These nineteen (19) buildings include 398 of the existing 742 EMCS points.

##### *Proposed*

A cost versus savings analysis was performed on eighty-three (83) buildings, some individually and some as "duplicate". Similar buildings were grouped together as duplicates as per the project scope. A Life Cycle Cost Analysis was run for the buildings with a Savings to Investment Ratio (SIR) calculated for each. The buildings with an SIR of greater than 1.25 are recommended to be included in the single UMCS Energy Conservation Opportunity (ECO) outlined in this section.

Buildings recommended to be included are as follows:

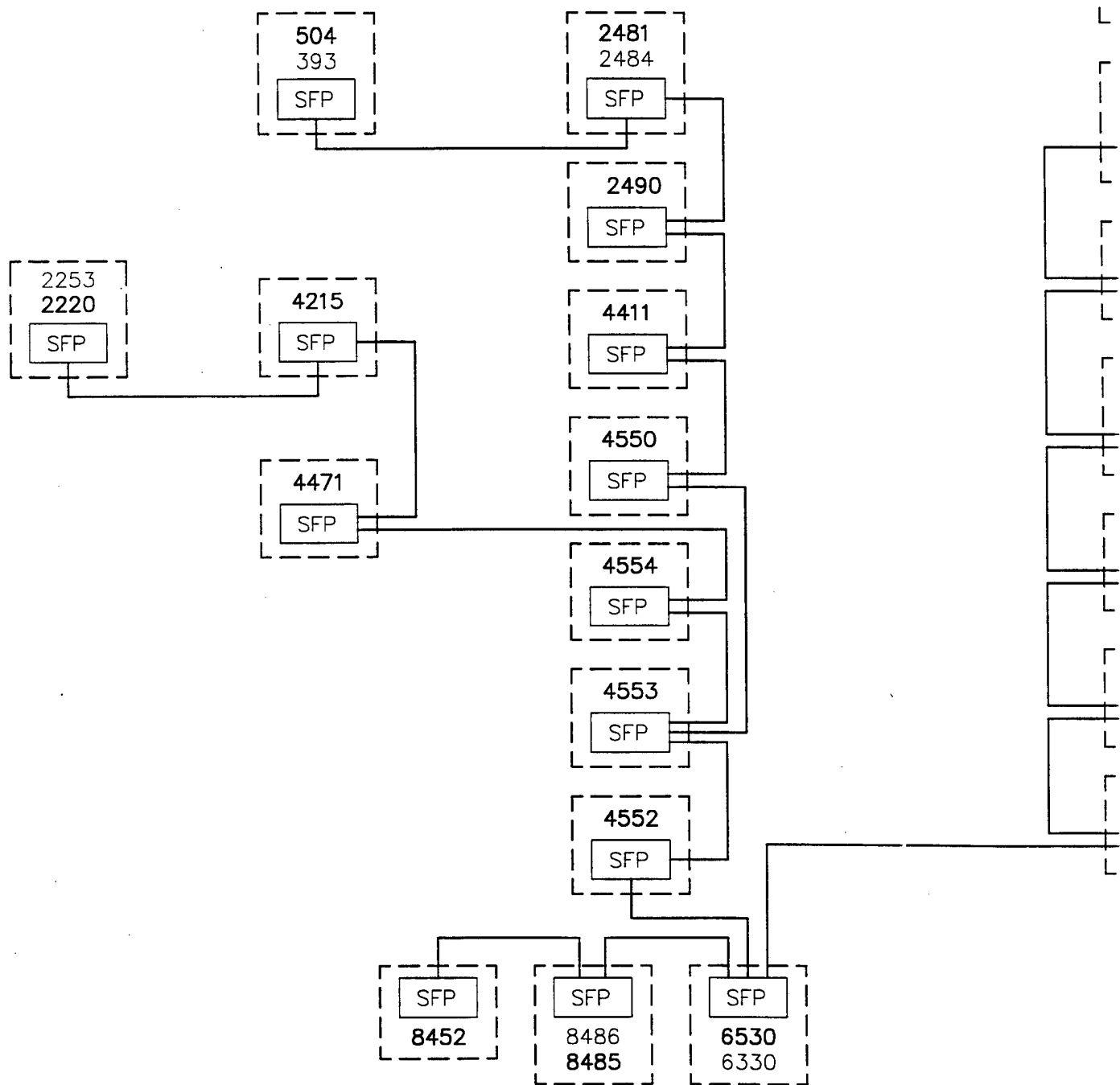
393	504	940	1976	1978	2220	2253	2481	2484
2490	2786	2790	3000	4215	4411	4471	4550	4552
4553	4554	4700	6330	6530	8452	8485	8486	9810
9827	9828	9829						

The new UMCS for Fort George G. Meade would consist of wire line Data Transmission Media (DTM) and intelligent stand alone UMCS smart Field Panels (SFP) connected to a new Central Control Unit (CCU) located in Building 3000. The new UMCS will be considered a medium UMCS configuration as described in the EMCS Manual, TM5-815-2. The CCU would consist of a microcomputer (PC) and associated peripheral devices (printers, etc.). The PC would house specific software-controlled strategy applications and programming which would be down-loaded to the individual SFPs. The SFP would be a stand-alone panel, meaning the programming for each building would reside in the building panel and through the DTM, the panels will exchange required information. Smaller stand alone Remote Terminal Units (RTU), Universal Programmable Controllers (UPC), and Unitary Controllers (UC) will be supplied by the SFPs. The wire line DTM network would be a combination of twisted pair wires and phone lines. Fiber Optic Transmission lines are not available and there are no plans by Fort Meade to install a Fiber Optic Data Communication System in the near future. Refer to the attached Figure Fig.-2 for UMCS schematic.

### ***Point List***

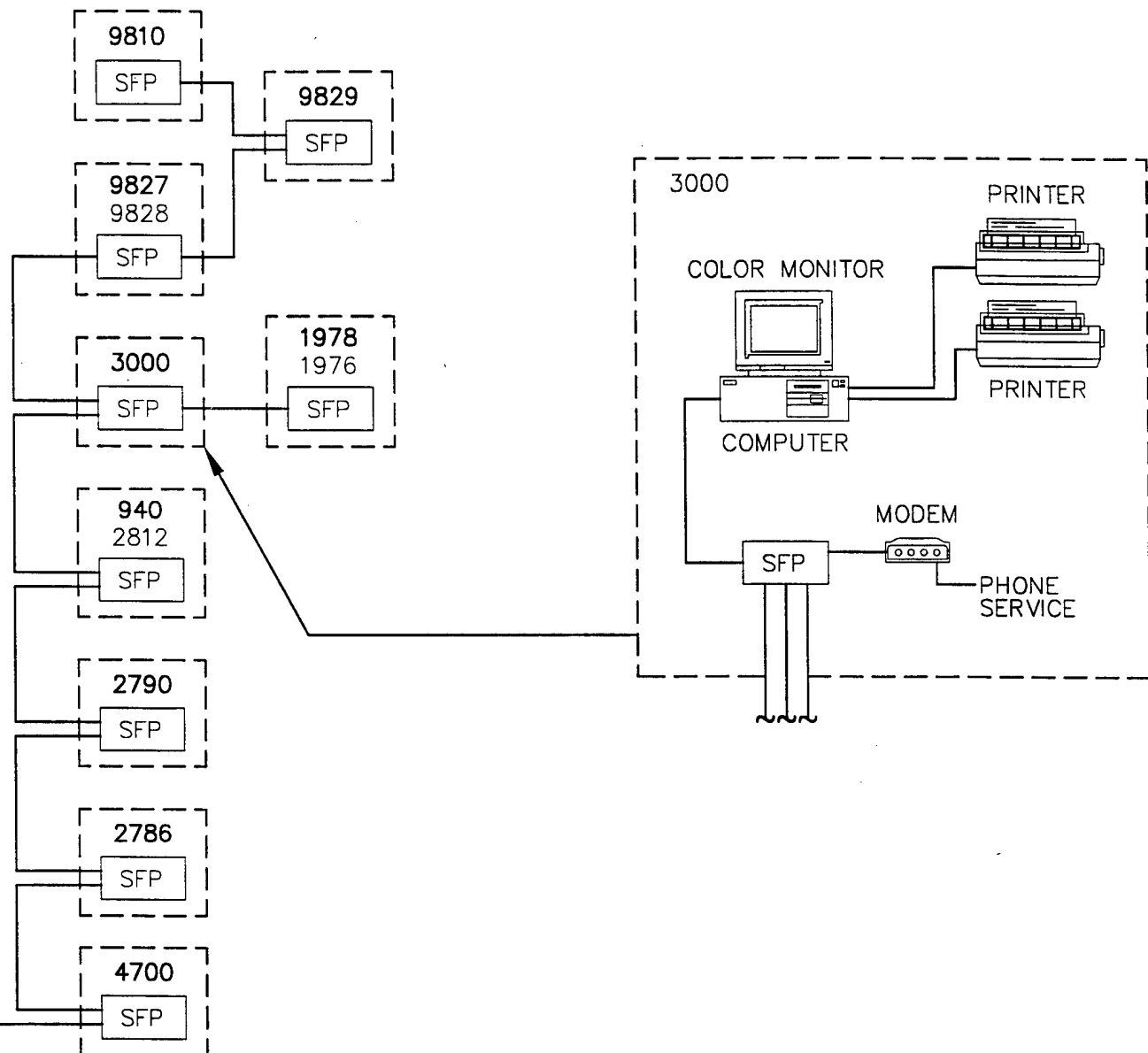
The total UMCS point count for the recommended buildings is 1.476 points. The individual building point counts are broken down in each Building by Building Analysis in Section 5.3.





# LEGEND

SFP SMART FIELD PANEL  
(BLDG. WITH SFP IN BOLD)



## FORT GEORGE G. MEADE

US ARMY CORPS OF ENGINEERS BALTIMORE, MD

### UMCS FEASIBILITY STUDY SYSTEM SCHEMATIC



**ENTECH Engineering Inc.**

4 SOUTH FOURTH STREET P.O. BOX 32 READING, PA 19603 (610) 373-6667  
1851 WEST END AVE P.O. BOX 389 POTTSTOWN, PA 17901 (717) 628-5655

DATE 7/19/96	DRAWN BY RJI	CHECKED BY CRS	PROJ. MGR. PAH	APPROVED DZG	
SCALE NONE	PROJECT NO. 4130.07	DRAWING NO. FIG-2	REVISION 0		

### ***Construction Cost***

The estimated cost to install a new UMCS at Fort Meade encompassing thirty (30) buildings is **\$1,395,120**. Each individual building costs is summarized in Table 6-1. An additional cost breakdown can be found in Attachment 8.4.

Construction	\$1,251,230
SIOH	\$ 68,820
Design	<u>\$ 75,070</u>
TOTAL	\$1,395,120

### ***Savings***

The total anticipated savings from the recommended buildings is \$386,590 plus \$47,950 in EMCS maintenance savings for a total savings of **\$434,900**. These figures are summarized in Table 6-2, Building Saving Summary and Table 6-3, Maintenance Cost Savings Summary. The individual building energy source savings are summarized in each Building by Building Analysis.

### ***Economics***

Using the LCCID Program, the economics for the project were calculated with all recommended buildings included. The LCCID output is as follows: (reference to attached LCCID output).

### LCCID Inputs

Electric Energy Saved	=	15,902.1 mmBtu (4,659,274 kWh x 3,413 Btu/kWh ÷ 1,000,000 Btu/mmBtu)
Oil Energy Saved	=	6,671.3 mmBtu (48,099 gallons x 138,700 Btu/gal ÷ 1,000,000 Btu/mmBtu)
Gas Energy Saved	=	47,572.6 mmBtu (46,142.2 mcf x 1,031,000 Btu/mcf ÷ 1,000,000 Btu/mmBtu)
Electric Demand Saved	=	82 kW
Construction \$	=	\$1,251,230
SIOH \$	=	\$68,820
Design \$	=	\$75,070
Maintenance \$	=	\$16,610 & \$47,950

Saving to Investment Ratio (SIR)	<b>2.69</b>
Simple Payback (Years)	<b>3.29</b>

### *Discussion*

The SIR of **2.69** and a simple payback of **3.29** years makes this ECO a candidate for ECIP funding. Table 5-4 is a system summary of each building to be included in the recommended ECO.

**TABLE 6 - 1**  
**COST ESTIMATE SUMMARY**

Site: FORT GEORGE G. MEADE  
Date: JULY 1996  
Name: Craig Snyder - Entech Engineering  
Phone: 610-373-6667

Bldg Number	Building Point Total	Smart Field Panels & Remote Terminal Units Costs			Unitary Controllers & Universal Programmable			Total Building Costs	20.0% Overhead & Profit	Sub-Total	1.25% Contractor Bond	Sub-Total	1.3% Escalation	Sub-Total	3.5% Contingency	System wide Cost / Bldg	Sub-Total	SIOH	6.0% Design	Total
		DDC Cost	Super Cost	Total Cost	DDC Cost	Super Cost	Total Cost													
393	12	\$0	\$0	\$0	\$0	\$3,730	\$3,730	\$3,730	\$750	\$4,480	\$60	\$4,540	\$60	\$4,600	\$160	\$1,890	\$6,650	\$370	\$400	\$7,420
504	5	\$0	\$0	\$0	\$0	\$5,570	\$5,570	\$5,570	\$1,110	\$6,680	\$80	\$6,760	\$80	\$6,840	\$240	\$790	\$7,870	\$430	\$470	\$8,770
940	16	\$0	\$0	\$0	\$0	\$7,570	\$7,570	\$7,570	\$1,510	\$9,080	\$110	\$9,190	\$110	\$9,300	\$330	\$2,520	\$12,150	\$670	\$730	\$13,550
1978	58	\$11,780	\$37,500	\$49,280	\$0	\$0	\$0	\$49,280	\$9,860	\$59,140	\$740	\$59,880	\$750	\$60,630	\$2,120	\$9,150	\$71,900	\$3,950	\$4,310	\$80,160
2220	26	\$2,500	\$10,800	\$13,300	\$0	\$0	\$0	\$13,300	\$2,660	\$15,960	\$200	\$16,160	\$200	\$16,360	\$570	\$4,100	\$21,030	\$1,160	\$1,260	\$23,450
		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
2253	6	\$0	\$0	\$0	\$0	\$2,770	\$2,770	\$2,770	\$550	\$3,320	\$40	\$3,360	\$40	\$3,400	\$120	\$950	\$4,470	\$250	\$270	\$4,990
		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
2481	22	\$9,280	\$2,130	\$11,410	\$0	\$0	\$0	\$11,410	\$2,280	\$13,690	\$170	\$13,860	\$170	\$14,030	\$490	\$3,470	\$17,990	\$990	\$1,080	\$20,060
2484	21	\$0	\$0	\$0	\$8,540	\$5,120	\$13,660	\$13,660	\$2,730	\$16,390	\$200	\$16,590	\$210	\$16,800	\$590	\$3,310	\$20,700	\$1,140	\$1,240	\$23,080
2490	45	\$0	\$37,920	\$37,920	\$0	\$0	\$0	\$37,920	\$7,580	\$45,500	\$570	\$46,070	\$580	\$46,650	\$1,630	\$7,090	\$55,370	\$3,050	\$3,320	\$61,740
2786	42	\$10,330	\$20,460	\$30,790	\$0	\$0	\$0	\$30,790	\$6,160	\$36,950	\$460	\$37,410	\$470	\$37,880	\$1,330	\$6,620	\$45,830	\$2,520	\$2,750	\$51,100
2790	100	\$28,060	\$0	\$28,060	\$0	\$0	\$0	\$28,060	\$5,610	\$33,670	\$420	\$34,090	\$430	\$34,520	\$1,210	\$15,760	\$51,490	\$2,830	\$3,090	\$57,410
3000	12	\$6,990	\$920	\$7,910	\$0	\$0	\$0	\$7,910	\$1,580	\$9,490	\$120	\$9,610	\$120	\$9,730	\$340	\$1,890	\$11,960	\$660	\$720	\$13,340
4215	42	\$0	\$42,980	\$42,980	\$0	\$0	\$0	\$42,980	\$8,600	\$51,580	\$640	\$52,220	\$650	\$52,870	\$1,850	\$6,620	\$61,340	\$3,370	\$3,680	\$68,390
4411	86	\$25,130	\$32,270	\$57,400	\$0	\$0	\$0	\$57,400	\$11,480	\$68,880	\$860	\$69,740	\$870	\$70,610	\$2,470	\$13,550	\$86,630	\$4,760	\$5,200	\$96,590
4471	9	\$0	\$0	\$0	\$0	\$5,060	\$5,060	\$5,060	\$1,010	\$6,070	\$80	\$6,150	\$80	\$6,230	\$220	\$1,420	\$7,870	\$430	\$470	\$8,770
4550	151	\$6,450	\$100,450	\$106,900	\$0	\$0	\$0	\$106,900	\$21,380	\$128,280	\$1,600	\$129,880	\$1,620	\$131,500	\$4,600	\$23,790	\$159,890	\$8,790	\$9,590	\$178,270
4552	91	\$17,420	\$26,990	\$44,410	\$0	\$0	\$0	\$44,410	\$8,880	\$53,290	\$670	\$53,960	\$670	\$54,630	\$1,910	\$14,340	\$70,880	\$3,900	\$4,250	\$79,030
4553	137	\$17,420	\$65,050	\$82,470	\$0	\$0	\$0	\$82,470	\$16,490	\$98,960	\$1,240	\$100,200	\$1,250	\$101,450	\$3,550	\$21,590	\$126,590	\$6,960	\$7,600	\$141,150
4554	154	\$7,830	\$73,060	\$80,890	\$0	\$0	\$0	\$80,890	\$16,180	\$97,070	\$1,210	\$98,280	\$1,230	\$99,510	\$3,480	\$24,270	\$127,260	\$7,000	\$7,640	\$141,900
4700	50	\$4,790	\$21,820	\$26,610	\$0	\$0	\$0	\$26,610	\$5,320	\$31,930	\$400	\$32,330	\$400	\$32,730	\$1,150	\$7,880	\$41,760	\$2,300	\$2,510	\$46,570
6330	28	\$7,310	\$16,510	\$23,820	\$0	\$0	\$0	\$23,820	\$4,760	\$28,580	\$360	\$28,940	\$360	\$29,300	\$1,030	\$4,410	\$34,740	\$1,910	\$2,080	\$38,730
6530	61	\$10,330	\$27,820	\$38,150	\$0	\$0	\$0	\$38,150	\$7,630	\$45,780	\$570	\$46,350	\$580	\$46,930	\$1,640	\$9,610	\$58,180	\$3,200	\$3,490	\$64,870
8452	65	\$30,770	\$7,450	\$38,220	\$0	\$0	\$0	\$38,220	\$7,640	\$45,860	\$570	\$46,430	\$580	\$47,010	\$1,650	\$10,230	\$58,890	\$3,240	\$3,530	\$65,660
8485	8	\$0	\$0	\$0	\$0	\$4,760	\$4,760	\$4,760	\$950	\$5,710	\$70	\$5,780	\$70	\$5,850	\$200	\$1,260	\$7,310	\$400	\$440	\$8,150
9810	65	\$17,190	\$19,710	\$36,900	\$0	\$0	\$0	\$36,900	\$7,380	\$44,280	\$550	\$44,830	\$560	\$45,390	\$1,590	\$10,230	\$57,210	\$3,150	\$3,430	\$63,790
9827	25	\$0	\$2,600	\$2,600	\$0	\$0	\$0	\$2,600	\$520	\$3,120	\$40	\$3,160	\$40	\$3,200	\$110	\$3,940	\$7,250	\$400	\$440	\$8,090
9828	25	\$0	\$2,100	\$2,100	\$0	\$0	\$0	\$2,100	\$420	\$2,520	\$30	\$2,550	\$30	\$2,580	\$90	\$3,940	\$6,610	\$360	\$400	\$7,370
9829	18	\$5,760	\$970	\$6,730	\$0	\$0	\$0	\$6,730	\$1,350	\$8,080	\$100	\$8,180	\$100	\$8,280	\$290	\$2,840	\$11,410	\$630	\$680	\$12,720
TOTAL BLDG COST		\$219,340	\$549,510	\$768,850	\$8,540	\$34,580	\$43,120	\$811,970	\$162,370	\$974,340	\$12,160	\$986,500	\$12,310	\$998,810	\$34,960	\$217,460	\$1,251,230	\$68,820	\$75,070	\$1,395,120
SYSTEM WIDE	1380	\$86,830	\$83,950	\$170,780				\$170,780	\$34,160	\$204,940	\$2,560	\$207,500	\$2,590	\$210,090	\$7,350	\$217,440				
TOTAL INSTALL COST		\$306,170	\$633,460	\$939,630	\$8,540	\$34,580	\$43,120	\$982,750	\$196,530	\$1,179,280	\$14,720	\$1,194,000	\$14,900	\$1,208,900	\$42,310		\$1,251,230	\$68,820	\$75,070	\$1,395,120

**UMCS FEASIBILITY STUDY  
FORT MEADE  
BUILDING SAVINGS SUMMARY  
TABLE 6 - 2**

<b>INCREMENTAL COSTS:</b>		
KWH:	\$0.032	Gallon of Oil:
KW:	\$96.28	MCF:
		Labor per Hour
		\$0.62
		\$3.97
		\$27.50

Building	Electric Usage Savings		Electric Demand Savings		#2 Fuel Oil Savings		Natural Gas Savings		Labor Savings		Total \$	Total mmBTU
	KWH	\$	KW	\$	Gallons	\$	MCF	\$	Hours	\$		
393	59,097	\$1,890	0.7	\$70	0	\$0	321.2	\$1,270	8	\$220	\$3,450	533
504	52,416	\$1,680	0.0	\$0	0	\$0	197.1	\$780	8	\$220	\$2,680	382
940	5,519	\$180	0.3	\$30	3,387	\$2,100	0.0	\$0	8	\$220	\$2,530	489
1978	209,099	\$6,690	6.0	\$580	0	\$0	860.6	\$3,420	28	\$770	\$11,460	1,601
1976												
2220	58,440	\$1,870	0.0	\$0	2,089	\$1,300	0.0	\$0	12	\$330	\$3,500	489
2253	34,944	\$1,120	0.0	\$0	0	\$0	179.7	\$710	4	\$110	\$1,940	305
2481	61,883	\$1,970	4.5	\$430	3,662	\$2,270	0.0	\$0	12	\$330	\$5,000	718
2484	62,672	\$2,010	0.0	\$0	2,529	\$1,570	0.0	\$0	12	\$330	\$3,910	565
2490	67,035	\$2,150	0.0	\$0	34,373	\$21,310	0.0	\$0	20	\$550	\$24,010	4,996
2786	184,264	\$5,900	0.0	\$0	0	\$0	1,093.6	\$4,340	16	\$440	\$10,680	1,756
2790	171,790	\$5,500	0.0	\$0	0	\$0	3,373.9	\$13,390	100	\$2,750	\$21,640	4,065
3000	5,732	\$180	1.5	\$140	0	\$0	462.6	\$1,840	8	\$220	\$2,380	497
4215	176,168	\$5,640	0.0	\$0	0	\$0	1,525.4	\$6,060	12	\$330	\$12,030	2,174
4411	476,660	\$15,250	3.4	\$330	0	\$0	2,373.6	\$9,420	28	\$770	\$25,770	4,074
4471	8,580	\$270	1.5	\$140	419	\$260	0.0	\$0	8	\$220	\$890	87
4550	473,710	\$15,160	19.8	\$1,910	0	\$0	7,134.9	\$28,330	40	\$1,100	\$46,500	8,973
4552	396,545	\$12,690	7.5	\$720	0	\$0	1,737.6	\$6,900	32	\$880	\$21,190	3,145
4553	688,592	\$22,030	14.9	\$1,430	0	\$0	5,881.5	\$23,350	36	\$990	\$47,800	8,414
4554	837,692	\$26,810	16.0	\$1,540	0	\$0	7,039.4	\$27,950	44	\$1,210	\$57,510	10,117
4700	6,177	\$200	0.7	\$70	0	\$0	1,099.1	\$4,360	24	\$660	\$5,290	1,154
6330	137,952	\$4,410	0.0	\$0	0	\$0	3,922.5	\$15,570	16	\$440	\$20,420	4,515
6530	43,572	\$1,390	0.9	\$90	0	\$0	1,752.9	\$6,960	20	\$550	\$8,990	1,956
8452	59,282	\$1,900	2.4	\$230	0	\$0	1,282.6	\$5,090	20	\$550	\$7,770	1,525
8485	0	\$0	0.0	\$0	1,640	\$1,020	0	\$0	8	\$0	\$1,020	227
8486												
9810	28,510	\$910	1.9	\$180	0	\$0	1,511.4	\$6,000	28	\$770	\$7,860	1,656
9827	4,176	\$130	0.0	\$0	0	\$0	363.7	\$1,440	8	\$220	\$1,790	389
9828	32,012	\$1,020	0.0	\$0	0	\$0	609.7	\$2,420	8	\$220	\$3,660	738
9829	25,154	\$800	0.0	\$0	0	\$0	1,633.1	\$6,480	16	\$440	\$7,720	1,770
<b>TOTALS</b>	<b>4,367,473</b>	<b>\$139,750</b>	<b>82.0</b>	<b>\$7,890</b>	<b>48,099</b>	<b>\$29,830</b>	<b>44,356.1</b>	<b>\$176,080</b>	<b>584</b>	<b>\$15,840</b>	<b>\$369,390</b>	<b>67,309</b>
<b>Total mmBTU</b>	<b>14,906.2</b>				<b>6,671.3</b>		<b>45,731.1</b>					<b>67,309</b>

**TABLE 6 - 3  
MAINTENANCE COST SAVINGS SUMMARY**

Existing Maintenance Costs		UMCS Maintenance Costs	
Annual Honeywell Service Contract	\$12,000	10% of System Wide Co	\$22,000
In-House Expenses:			
Repair of EMCS	\$8,300	1% of Total Bldg Cost	\$15,000
Service Orders EMCS Related	\$71,700		
20% HVAC Service Orders EMCS Related	\$59,300		
Bldgs not included in study	(\$9,690)		
<b>Total</b>	<b>\$141,610</b>		<b>\$37,000</b>

BLDG	EXIST POINT COUNT	CURRENT MAINTENANCE COST	NEW UMCS MAINTENANCE COST	MAINTENANCE COST SAVINGS
80	5	\$620		
84	3	\$370		
85	11	\$1,370		
90	4	\$500		
370	20	\$4,280		
504	6	\$1,270	\$580	\$690
940	6	\$1,270	\$580	\$690
2212	6	\$1,270		
2220	7	\$1,490	\$680	\$810
2234	8	\$1,700		
2246	3	\$370		
2253	3	\$640	\$290	\$350
2257	8	\$1,700		
2481	9	\$1,920	\$870	\$1,050
2501	3	\$640		
2789	11	\$2,340		
2790	42	\$8,970	\$4,070	\$4,900
2812	2	\$430		
4215	10	\$2,130	\$970	\$1,160
4216	6	\$1,270		
4217	5	\$1,070		
4408	4	\$500		
4411	10	\$2,130	\$970	\$1,160
4418	7	\$1,490		
4419	8	\$1,700		
4431	8	\$1,700		
4432	14	\$3,000		
4463	3	\$370		
4471	8	\$1,700	\$770	\$930
6600	4	\$860		
4550	44	\$9,390	\$4,260	\$5,130
4551	9	\$1,920		
4552	36	\$7,690	\$3,490	\$4,200
4553	56	\$11,970	\$5,420	\$6,550
4554	42	\$8,970	\$4,070	\$4,900
4680	4	\$860		
4700	33	\$7,040	\$3,200	\$3,840
4703	3	\$640		
4704	3	\$640		
4705	3	\$640		
4707	3	\$640		
4709	3	\$640		
4720	8	\$1,700		
6330	13	\$2,780	\$1,260	\$1,520
6530	14	\$3,000	\$1,360	\$1,640
7100	7	\$1,490		
8451	13	\$1,620		
8452	23	\$4,910	\$2,230	\$2,680
8465	7	\$1,490		
8472	8	\$1,700		
8476	4	\$860		
8478	11	\$2,340		
8479	4	\$860		
8487	3	\$370		
8501	4	\$500		
8503	6	\$750		
8543	4	\$500		
8544	5	\$1,070		
8545	11	\$2,340		
8605	11	\$2,340		
8606	11	\$2,340		
8607	5	\$1,070		
8609	5	\$1,070		
8610	11	\$2,340		
8611	4	\$860		
9801	9	\$1,920		
9802	7	\$1,490		
9803	9	\$1,920		
9804	7	\$1,490		
9810	18	\$3,850	\$1,740	\$2,110
9827	4	\$500		
9828	11	\$1,370		
9829	2	\$430	\$190	\$240
	<b>742</b>	<b>\$151,380</b>	<b>\$37,000</b>	<b>\$44,550</b>



**TABLE 6-4**  
**UMCS FEASIBILITY STUDY**  
**FORT MEADE**  
**DISTRIBUTED-PROCESS MONITOR AND CONTROL SYSTEMS (UMCS)**  
**SYSTEMS SUMMARY ECONOMICS ANALYSIS**

Building	Number of Points	Savings			EMCS Maintenance \$	First Costs				
		mmBtu	Dollar \$			Construction Cost \$	SIOH \$	Design Cost \$	Building Total \$	
393	12	533	\$3,450			\$6,650	\$370	\$400	\$7,420	
504	5	382	\$2,680		\$690	\$7,870	\$430	\$470	\$8,770	
940	16	489	\$2,530		\$690	\$12,150	\$670	\$730	\$13,550	
1978	58	1,601	\$11,460			\$71,900	\$3,950	\$4,310	\$80,160	
1976										
2220	26	489	\$3,500		\$810	\$21,030	\$1,160	\$1,260	\$23,450	
2253	6	305	\$1,940		\$350	\$4,470	\$250	\$270	\$4,990	
2481	22	718	\$5,000		\$1,050	\$17,990	\$990	\$1,080	\$20,060	
2484	21	565	\$3,910			\$20,700	\$1,140	\$1,240	\$23,080	
2490	45	4,996	\$24,010			\$55,370	\$3,050	\$3,320	\$61,740	
2786	42	1,756	\$10,680			\$45,830	\$2,520	\$2,750	\$51,100	
2790	100	4,065	\$21,640		\$4,900	\$51,490	\$2,830	\$3,090	\$57,410	
3000	12	497	\$2,380			\$11,960	\$660	\$720	\$13,340	
4215	42	2,174	\$12,030		\$1,160	\$61,340	\$3,370	\$3,680	\$68,390	
4411	86	4,074	\$25,770		\$1,160	\$86,630	\$4,760	\$5,200	\$96,590	
4471	9	87	\$890		\$930	\$7,870	\$430	\$470	\$8,770	
4550	151	8,973	\$46,500		\$5,130	\$159,890	\$8,790	\$9,590	\$178,270	
4552	91	3,145	\$21,190		\$4,200	\$70,880	\$3,900	\$4,250	\$79,030	
4553	137	8,414	\$47,800		\$6,550	\$126,590	\$6,960	\$7,600	\$141,150	
4554	154	10,117	\$57,510		\$4,900	\$127,260	\$7,000	\$7,640	\$141,900	
4700	50	1,154	\$5,290		\$3,840	\$41,760	\$2,300	\$2,510	\$46,570	
6330	28	4,515	\$20,420		\$1,520	\$34,740	\$1,910	\$2,080	\$38,730	
6530	61	1,956	\$8,990		\$1,640	\$58,180	\$3,200	\$3,490	\$64,870	
8452	65	1,525	\$7,770		\$2,680	\$58,890	\$3,240	\$3,530	\$65,660	
8485	8	227	\$1,020			\$7,310	\$400	\$440	\$8,150	
8486										
9810	65	1,656	\$7,860		\$2,110	\$57,210	\$3,150	\$3,430	\$63,790	
9827	25	389	\$1,790			\$7,250	\$400	\$440	\$8,090	
9828	25	738	\$3,660			\$6,610	\$360	\$400	\$7,370	
9829	18	1,770	\$7,720		\$240	\$11,410	\$630	\$680	\$12,720	
TOTALS	1,380	67,309	\$369,390	\$44,550		\$1,251,230	\$68,820	\$75,070	\$1,395,120	
					SIR					2.65
					Simple Payback (years)					3.33



LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: MEADE4

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FORT MEADE REGION NOS. 3 CENSUS: 3

PROJECT NO. & TITLE: 4130.07 UMCS FEASIBILITY STUDY

FISCAL YEAR 1996 DISCRETE PORTION NAME: TOTAL125

ANALYSIS DATE: 07-19-96 ECONOMIC LIFE 10 YEARS PREPARED BY: CRAIG SNYDER

1. INVESTMENT

A. CONSTRUCTION COST	\$	1282190.		
B. SIOH	\$	70510.		
C. DESIGN COST	\$	76930.		
D. TOTAL COST (1A+1B+1C)	\$	1429630.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$		0.	
F. PUBLIC UTILITY COMPANY REBATE	\$		0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)				\$ 1429630.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1995

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 9.40	15902.	\$ 149480.	8.18	\$ 1222744.
B. DIST	\$ 4.50	6671.	\$ 30021.	9.64	\$ 289401.
C. RESID	\$ .00	0.	\$ 0.	9.50	\$ 0.
D. NAT G	\$ 3.85	47573.	\$ 183155.	9.51	\$ 1741800.
E. COAL	\$ .00	0.	\$ 0.	8.23	\$ 0.
F. LPG	\$ .00	0.	\$ 0.	8.84	\$ 0.
M. DEMAND SAVINGS			\$ 7890.	8.07	\$ 63672.
N. TOTAL		70146.	\$ 370545.		\$ 3317617.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		
(1) DISCOUNT FACTOR (TABLE A)	8.07	\$ 64560.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 520999.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
d. TOTAL	\$ 0.			0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) / COST(-) (3A2+3Bd4) \$ 520999.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 435105.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.29 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 3838616.

7. SAVINGS TO INVESTMENT RATIO (SIR) =  $(6 / 1G) =$  2.69  
(IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 14.91 %

## 7.0 CONCLUSION

The recommended UMCS ECO includes thirty (30) buildings at a construction cost of \$1,429,630 with a savings of \$434,900. These numbers translate to a simple payback of 3.29 years and a Savings to Investment Ratio (SIR) of 2.69. This project will qualify for ECIP funding since the SIR is greater than 1.25, the simple payback is less than 10 years, and the construction cost is greater than \$300,000.

This suggested, the UMCS ECO has a total point count of 1,380 points. This point count and the construction cost of \$1,429,630 translates to a dollar per point cost of \$1,036/pt. Industry costs range from \$800/pt to \$1,200/pt. This places the UMCS cost at the middle of the range, which means the UMCS costs are reasonable.

Of the eighty-three (83) buildings included in the study only 36% of the buildings met the required criteria to be included in the recommended UMCS ECO. The recommended ECO includes most of the major buildings on the base. The eighty-three (83) buildings represent a total area of 2,645,816 square feet. The thirty (30) buildings in the recommended UMCS ECO represent a total area of 1,326,781 square feet, which accounts for 50% of the total area studied. These thirty (30) buildings will provide Fort Meade with a good system to build on in the future. Once the UMCS system is installed, buildings that are renovated and not already on the system can be readily added to the system. The existing EMCS system can still operate where it needs to be independent of the new UMCS.

It is not surprising that the thirty buildings finally selected to be included within the recommended ECO tend to be the larger; more mechanically intensive, facilities offering the type of energy saving opportunities that justify the expense of installing a new UMCS system. The remaining facilities are small facilities with elementary mechanical system offering little opportunities for any substantial energy savings.

All but three of the dormitory buildings are not recommended since they must operate 24-hours per day. The 24-hour a day operation does not allow for occupied/unoccupied cycling. Building 2481 is recommended because it is conditioned by a single unit which limits the amount of control points required and lowers the construction cost. Building 9827 and 9828 are recommended due mainly to a low construction cost. These buildings are currently under restoration and as part of the restoration a new DDC energy management control system is being installed. The construction cost only includes costs to connect the building EMCS to the new base UMCS.